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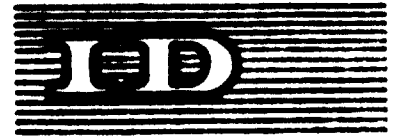
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MANAGING THE TRANSFER OF KNOW-HOW ^{1/}

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Introduction

1. Transfer of know-how is part of the wider problem of transfer of technology. The discussion and specialist literature on the subject of technology transfer, and particularly know-how transfer, is comparatively recent. It does not mean, of course, that transfer itself is a recent invention; it has been taking place throughout history. Its new importance, however, is due to the realisation that it can make a major contribution to the economic growth of developing countries. In this sense it assumes an important role and, as a result, there is an immediate and urgent need to develop a new branch of knowledge with the accompanying methodology, in order to cope with the size and complexity of the task.

2. As with any kind of activity which enters the arena of scientific scrutiny, the conceptual framework is still fluid and there are difficulties with terminology. Concepts and terminology will change and develop as our understanding of transfers becomes more complete. The first aim of this paper is therefore to state what sort of concepts and terms we, at Atkins, currently use when working in this field. These concepts will then be used to describe the mechanism of know-how transfers, on the basis of which we shall put forward the thought that there is a need for a separate managerial function. It is hoped that the paper will stimulate discussion, in order to explore further the many aspects of this problem.

Concepts and terminology

3. What, then, is know-how? The term is used extensively in commercial transactions, involving establishment of complete new plants, in new environments. The agency which undertakes to establish such a new plant agrees to supply a total and complete package of knowledge, procedures, methods and so on, as part of the transaction. This concept of totality is usually associated with commercial know-how agreements.

4. It will be appreciated that the above simple facade conceals a complicated situation. An industrial operation, involving conversion of raw materials into finished products, is based on scientific knowledge backed by technical knowledge - root sciences and technology. Clearly, this part is transferable by means of a

formal or informal educational process. At Atkins we call this body of knowledge the 'know-why'.

5. But in addition to scientific and technical knowledge, there is a need for understanding and codification of the empirical procedures and methods based on experience; in Professor Sveinilson's words¹, there is a need for 'capacity to apply the technical knowledge'. The 'know-how' can be identified with this capacity to apply scientific and technological principles.

6. For example, the knowledge of dynamics, metallurgy, statistical quality control, computer theory and so on, provides the 'know-why' for a steel rolling mill; the 'know-how' will enable the mill to be operated efficiently.

7. The area of know-how is wide and it is difficult to determine where know-why ends and know-how begins. But within this broad band of know-how, at one, - the simplest, - end of the spectrum we have empirical activities which are universal, codifiable, and usually easy to describe verbally. This area of know-how is firmly in the domain of objective and universal facts and procedures, and methods for transferring it are comparatively well understood.

8. Next we have the know-how which is dependent on specific local conditions such as the types of input materials (ores, coal), climatic conditions, and so on. At this point the participants of a transfer of know-how face for the first time the situation in which they are actually beginning to create new know-how, related to local conditions.

9. Finally, we have a large part of know-how which is related to the fact that we are dealing not merely with physical systems but also with human systems superimposed onto them. This area is closely related to behaviour and habits of people, their traditions, culture, history and so on. Behavioural know-how developed in the environment of Sheffield or Essen may be totally irrelevant in Korea, Brazil or Uganda. It is in this behavioural area that people, who are involved in the transfer of know-how, completely cease transferring it and become faced with the real problem of creation of know-how.

10. The introduction of the concept of creation of know-how as part of the process of transfer of know-how, particularly at its most difficult end where behavioural aspects become predominant, is deliberate. The point really is that creation and transfer are inseparable in the sense that transfer inevitably leads to joint creation. It is appreciated that new centres of learning, research, consultancy or design are sources of self-sustained creative activity, but even then the distinction is not clear-cut; after all, the launching of such centres is normally triggered off by some kind of transfer exercise in the initial stages, which in itself involves a degree of creative activity in the sense described here. Again, it must be remembered that certain kinds of know-how can only be generated in the full scale environment of a commissioned plant; bearing in mind the importance of early maximum utilisation, there is generally a need for transfers in the early stages of new plant's existence in order to accelerate the build-up of operational know-how.

11. The different kinds of know-how described above can be illustrated by examples in the field of plant maintenance. We have, first of all, the understanding of the symptoms of malfunctioning or of an imminent failure. The knowledge of these symptoms and the accompanying trouble-shooting procedures give an example of the transferable know-how which is independent of local conditions.

12. However, an experienced maintenance man will know that in any one set of physical conditions, some causes of malfunction or failure are usually predominant. The ability to short-list such causes in the light of local conditions is the type of know-how which is not transferable and which must be created.

13. Finally, we have the requirement to operate a maintenance organisation in which some men will be required to observe and report the symptoms and others will be expected to assess this information and initiate remedial action. This human system and its functioning will be strongly influenced by the behavioural characteristics of the people involved, and any transfer exercise aimed at devising a human system for effective monitoring of the plant will involve a joint creation of know-how by the participants of the transfer.

14. We have indicated the existence of operational know-how required for efficient operation of new assets. In the past there has been much emphasis on the initial stages leading to creation of fixed assets in new surroundings; much effort and much attention has been devoted to the generation of resources, or capital, and to all the activities culminating in the commissioning of new facilities. The Asian Development Bank pointed out in its last annual report that there exists such a lack of balance in the emphasis placed on the mere fact of achieving investment and, on the other hand, on the levels of productivity from such investments. It can be said that similar lack of balance exists in the application of know-how during the creation of fixed assets and during subsequent exploitation of such assets. It seems to us that much emphasis is required and much useful work could be done in the future in the area of know-how transfer and creation for the purpose of operating efficiently new assets, which still find it difficult to achieve its targets.

15. Summarising, we suggest that:

- (a) there is a distinction between the 'know-why' - the scientific and technical knowledge on which any industrial activity is based, - and the 'know-how', which is concerned with the capacity to use such knowledge;
- (b) the area of know-how can be divided into that which relates to empirical and codifiable facts which are universal, and that which is dependent on the specific environment, both physical and human; the latter requires a degree of creative activity;
- (c) it is difficult to separate the creation of know-how and the transfer of know-how; creation and transfer are seen as two inseparable aspects of the same general process of technology transfer;
- (d) the know-how, specifically related to the operation of industrial enterprises as distinct from creation of new assets, requires a great deal of emphasis, if full benefits from new investment in developing countries are to be realised in the future.

The nature of know-how transfer

16. Transfers of know-how take place in a great variety of situations. They constantly occur amongst the countries of Europe and between Europe and North America. Transfers take place increasingly amongst developing countries. Europe is now receiving know-how from Japan. In this multiplicity of situations there is, however, one common characteristic which has an influence on the nature of transfer: there exists in all cases, - to a greater or lesser extent, - a cultural difference. Such a difference can be detected in a transfer involving Newcastle and London: it is perhaps stronger between Holland and England, stronger still between Germany and Spain, and very considerable indeed between any European country and, for example, a country in Africa.

17. The word 'transfer' implies a unidirectional process and, superficially, the process appears to involve a 'giver' and a 'receiver'. In our view this is a gross over-simplification. The actual mechanism of transfer is very much more complex and involves two reciprocal currents. We have discussed the know-why and the know-how and the behavioural end, where most of the creation of know-how takes place. It is at this difficult behavioural end where, in our view, the reverse transfer takes place.

18. The possessor of the transferable kind of know-how is placed in a new cultural environment, of which he will know little. The joint attempt at extending his objective know-how to embrace the human systems must be preceded, first of all, by reverse transfer of straightforward basic knowledge about the traditions, habits, and so on, of the people he is dealing with, and then followed by a joint attempt to accommodate the industrial activity in this cultural context. In this light, the traditional concept of a 'giver/receiver' relationship becomes misleading. We think that the relationship can be better described as a 'partnership', in which there should be a flow of know-how and knowledge in both directions. The appreciation of this point is absolutely crucial for effective transfer; full involvement and participation of both principal parties is essential.

19. We put forward now the thesis that the essence, - the central feature, - of any know-how transfer is the personal relationship between the participants of the transfer. The effectiveness of transfer is largely dependent on the success of this relationship.

20. Any personal relationship presents a challenge, but the relationship of the participants in a transfer of know-how will involve a particular challenge, since it will normally take place across a strong culture difference. A lot, clearly, depends on goodwill and a reasonable feel for the situation, but it must be recognised that we are here identifying yet another aspect of transfer which is also dependent on human behaviour: the behaviour of the participants.

21. Before we recapitulate the components of any know-how transfer, we must pause to devise suitable names to replace the traditional, and largely irrelevant, 'giver/receiver' terminology; this surprisingly difficult task has led us in the past to an analogy of a chemical reaction involving two reacting agents. Thus, for the purpose of this paper, we have, first of all, the guest reactant ('reactant G'), who arrives with a store of objective and transferable know-how. 'Reactant G' will be confronted with the host reactant ('reactant H'), and the central feature of the process will be their relationship as individuals. Both 'reactants' will be armed with the know-why - the scientific and technical knowledge - and it should be pointed out at once that situations are very common indeed where 'reactant H' has a wider and deeper store of knowledge than the 'reactant G' who comes to transfer the know-how. The relationship of the two participants is across a culture difference.

22. To complicate matters further, neither of the two participants may have any formal training, or indeed facility, in the science of communications. It is this component of cross-cultural communications which brings us to the idea of the 'total management' of the transfer.

Managing the transfer of know-how

23. We have seen that transfers involve reactants who participate in an exchange and in a joint creation of know-how. The process takes place across a culture difference and there may be a lack of communications expertise. There usually exists the involvement and the influence of the parent enterprises from which the reactants are drawn, and also of any sponsoring organisations. Furthermore, if transfers are to take place in the area of complex industrial activity such as steelmaking where there is complete interdependence of constituent stages of production, and where the management structure is correspondingly sophisticated, there is usually a need for a multiplicity of visits over an extended period. In such situations there is a case for a third distinct participant in the process, the manager. We may again use the analogy of the chemical reaction and describe the manager as the 'catalyst' of the transfer.

24. There are several roles which the total management of transfer must discharge: there is the requirement for the formulation of terms of reference and for identification of needs, definition of tasks and presentation of results of transfer; there is a need for structuring and planning of each individual transfer; there is, finally, a need for administrative services. Above all, there is the requirement for injection of specialised expertise in the area of trans-culture communications from a suitable source.

25. It is impossible to include in this paper a full discussion of the many aspects of such a distinct managerial function. Instead, it is proposed to concentrate on only two specific topics which seem to us important and which illustrate at the same time the principal aspects of such a managerial function: the control of environment to the extent possible, and the control of the transfer itself for maximum effectiveness and efficiency.

The control of environment

26. The single decisive instrument available to the management of the transfer to influence the environment in which the transfer will take place, is the formulation of the terms of reference for the programme. The range of possibilities is considerable and each situation requires a specific approach.

Perhaps the best indication of the scope available to the manager in this respect can be given by describing the two fairly extreme types of terms.

27. One, - the more common, - type of operation is based on long-term secondments, in which the 'reactant G' is placed alongside the 'reactant H' for perhaps two to three years, or even longer. The advocates of this approach will point out the many obvious advantages: there is sufficient time to establish the relationship and to acquire sufficient knowledge of the new surroundings; the new arrival has time to identify himself with the day-to-day life of the host enterprise and to participate in its management, formally or informally; the 'reactant G' may ultimately become almost entirely integrated with the host organisation.

28. The other type of operation is based on a succession of fairly quick task-orientated transfers in closely defined areas of operation. The emphasis here is on a detached and critical look at any one or a series of specific tasks involving current operations of physical systems. The 'reactant G' is positively discouraged from managerial involvement in the host enterprise.

29. The terms of reference cannot be devised by the manager of the transfer in isolation. They must be acceptable, - indeed welcome, - to both participating organisations and through them to the individuals who will carry out the transfers.

30. The control of environment cannot be separated from the understanding of environmental constraints. This can be a topic for a separate paper, but for the present purpose it is sufficient to point out that, in general, each individual transfer cannot be regarded as operating in isolation. Such micro-activities are dependent on the macro-situations in which they take place, and it is important that the participants of a transfer should be aware of the boundaries within which their joint solutions must remain.

The control of transfer

31. The objective for the manager of transfer of know-how must be to ensure that the transfer is effective and efficient. There is a need therefore for control, particularly if we are dealing with a succession of individual

transfers. The control required for good management, - the 'on-line' control, - must be such as to ensure that a programme of this kind is guided by a system of feedback and continuous correction during the execution.

32. The control mechanisms and their functioning can also be a subject for a separate paper; they involve selection, close briefing, task formulation, planning of each individual transfer and also the sequence of transfers, debriefing and reporting. However, before any such elaborate system can be effective, it is necessary to define a set of measuring devices, which would enable us to assess the effectiveness of the transfer.

33. It is important at this stage to make a distinction between the measurable overall improvement in the performance of an enterprise as a result of a transfer, and the effectiveness of the transfer itself. A successful transfer need not necessarily imply an immediate successful implementation, if the performance of the enterprise is also dependent, as it often is, on such external influences as a major change in an upstream process or an improvement in the social climate. There is therefore a need for methods which will enable us to assess the effectiveness of any one individual case of transfer in isolation. We believe that such methods can, in fact, be devised and we suggest the following, as examples: a measure of success may be provided by the desire of the reactants to continue the relationship and we can use the mechanism of debriefing to obtain the views on this from the participants; or we can attempt a comparison of statements by the participants, describing the situation under scrutiny; a significant measure of effectiveness of transfer may be given by the convergence of the two points of view towards the end of the transfer. There may be difficulties in the quantification of some of these effects but a convincing composite picture may be formed on the basis of several such yardsticks taken together. There is much scope for further research in this area.

34. Any major programme involving a controlled series of transfers accumulates an important fund of knowledge and information. An analysis of this material at the end of the programme may contribute significantly to

the store of methodology in this very important and developing area. It is possible that such analysis may ultimately enable a useful model for the mechanism of the transfer to be built. We must recognise that we are some way away from this, but it is reasonable to assume that there may be a pattern of optimal matching of the two participants. Each participant, after all, presents a composite picture of personal, environmental and professional characteristics, combined with a set of motives at national, organisational and personal levels. These characteristics will define a specific 'profile' for each individual and the object of the model-building exercise could be to devise methods for bringing together two such 'profiles' for best joint performance.

35. The question must be asked, what percentage of resources, allocated to any major transfer programme, should be channelled into the total management of the undertaking. It is reasonable to expect that there exist, for different types of transfers, optimum relationships between the management costs and total costs. Our knowledge of these relationships is still very limited and we suggest that a useful start in this area could be made by analysing the costs of current programmes if access is available to a sufficiently wide pool of information on this subject.

Motivation of participants

36. It will be appropriate to conclude this paper with a reference to the problem of motivation of the participants of a transfer. The correct and effective motivation of those involved is of immense importance, since without this, the sort of joint participation described above cannot take place. The motives of both the 'reactant G' and the 'reactant H' may be different, but they must be coincidental in the sense that both parties are equally committed to the success of the joint task.

37. Quite apart from the wider considerations involving the global need for acceleration of progress and economic growth, there must be, at individual level, a conviction that participation, - in whatever role, - in a transfer of this type is an essential part of any useful and progressive career. In our view, the importance of technology transfer is such that no-one can consider

himself fully educated and experienced without some involvement in it.

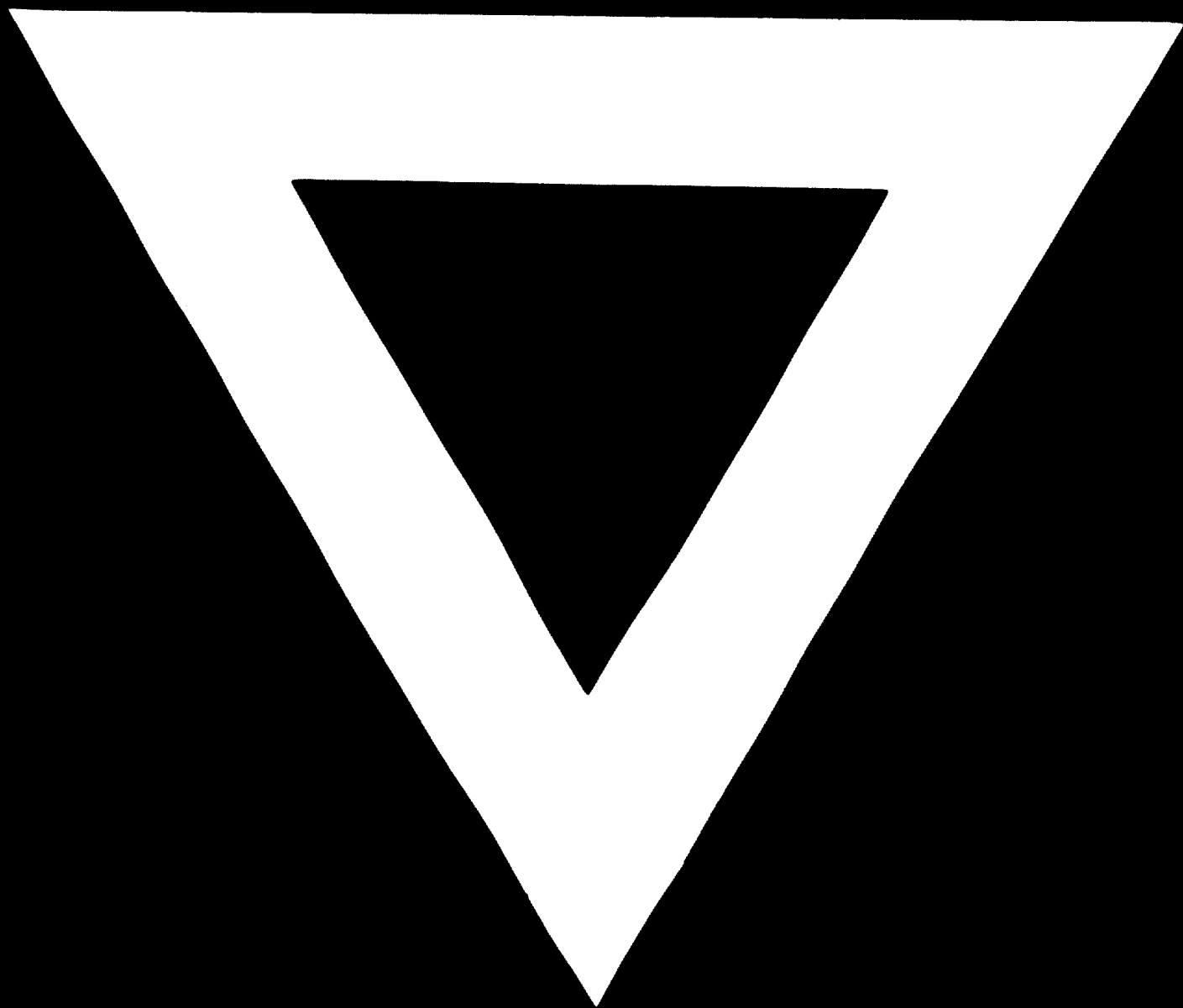
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