



TOGETHER
for a sustainable future

OCCASION

This publication has been made available to the public on the occasion of the 50th anniversary of the United Nations Industrial Development Organisation.



TOGETHER
for a sustainable future

DISCLAIMER

This document has been produced without formal United Nations editing. The designations employed and the presentation of the material in this document do not imply the expression of any opinion whatsoever on the part of the Secretariat of the United Nations Industrial Development Organization (UNIDO) concerning the legal status of any country, territory, city or area or of its authorities, or concerning the delimitation of its frontiers or boundaries, or its economic system or degree of development. Designations such as “developed”, “industrialized” and “developing” are intended for statistical convenience and do not necessarily express a judgment about the stage reached by a particular country or area in the development process. Mention of firm names or commercial products does not constitute an endorsement by UNIDO.

FAIR USE POLICY

Any part of this publication may be quoted and referenced for educational and research purposes without additional permission from UNIDO. However, those who make use of quoting and referencing this publication are requested to follow the Fair Use Policy of giving due credit to UNIDO.

CONTACT

Please contact publications@unido.org for further information concerning UNIDO publications.

For more information about UNIDO, please visit us at www.unido.org



06669



United Nations Industrial Development Organization

Distr.
LIMITED

ID/WG.203/4
6 October 1975

ORIGINAL: ENGLISH

Workshop on the Commercialization
of Industrial Research Results

Osaka, Japan 10-14 November 1975

Commercialization of Industrial
Research Results 1/

J.B. Wilkinson *

1/ The views and opinions expressed in this paper are those of the author and do not necessarily reflect the views of the secretariat of UNIDO.

* Head of Research Policy Secretariat, Unilever Ltd., London, England.

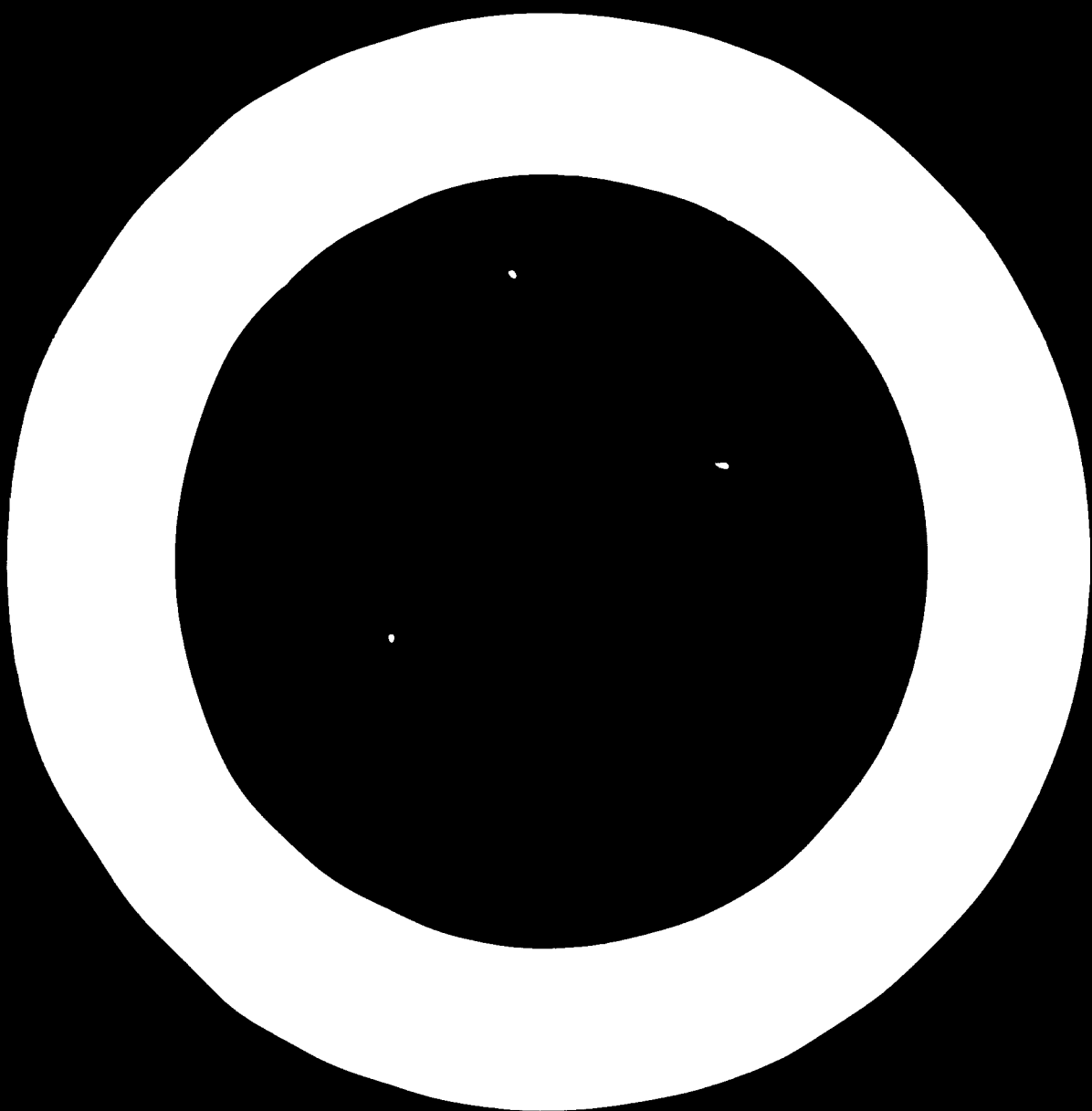
We regret that some of the pages in the microfiche copy of this report may not be up to the proper legibility standards even though the best possible copy was used for preparing the master fiche

CONTENTS

<u>Chapter</u>	<u>Page</u>
Summary	iii
Introduction	1.
I. The Business Environment	1.
II. The Matrix	3.
III. Communications	5.
IV. Examples of Commercialisation of Research Results	7.
V. Recommendations	8.
References	10.

SUMMARY

1. Experience over many years in a large international company with a substantial R. & D. effort has shown that commercial success in operation is dependent not only on the quality of the scientific and business skills but also on the nature of the communication process between the respective managements.
2. It is necessary for the morale of both research and business teams to be high and for them to respect each other. It is also necessary for each at appropriate management levels to understand each other's objectives, resources and limitations.
3. The commercial side must particularly understand the time factors involved in creating a research resource and obtaining useful output from it; research cannot be switched on and off like a light, but has a high moment of inertia.
4. The research side must nevertheless build its scientific and technological resource in such a form as to provide maximum flexibility in areas of probable need, yet not thereby prejudicing the degree of skill in areas of necessary specialisation.
5. Assuming these basic requirements are met, the need then is for organisational mechanisms to permit and encourage a continued dialogue between the parties. By this means, research can understand the long-term policies and scenarios of the business, as well as the short-term needs. And the business can learn from research what is available and practical and for what future developments planning is needed - also what developments should not be expected.
6. Recommendations for achieving this dialogue are proposed (in particular the Matrix approach to Research Management) and will be developed from a practical angle.



INTRODUCTION

This paper is written from the point of view of a Research Manager from a large company operating internationally. The Concern has throughout the world a number of Research Laboratories and a much larger number of national operating companies manufacturing and selling products. These products are largely, but not entirely, consumer products - mostly food but also detergents and toiletries.

Every company has the problem of commercialising its research - very much so, since the profits from the commercialisation must pay year in and year out the costs of research (1). As befits a Workshop meeting, the practical aspects of the problem will be the main issue. It is no great stretch to compare the Industrial Research Institutes defined in the Aide-Memoire for this Workshop with the Research Laboratories which my company operates. Indeed the criteria for assessing the effectiveness of Institutes as published by UNIDO (2) would be endorsed whole-heartedly by any Research Manager in industry. Only the section on Communications (3) needs further development and that will be given; suggestions or recommendations based on industrial experience will be largely in this area.

The problems of effectiveness in commercialising Research results are certainly not problems confined to developing countries or state organizations - they are fundamental issues of Research Management and the interface between Research and its commercial partners. Experiences in this field can most readily be shared.

I THE BUSINESS ENVIRONMENT

The UN World Plan of Action (4) for harnessing science and technology provides a solid background which is in principle as applicable to a private business as to a newly developing country. The steps to be taken, so carefully spelled out in the various sections, are ones we all recognise. The more detailed information in the Regional Plans now

appearing seriatim (5) is applicable to all who research or trade in the region.

These particular papers are emphasised because they exemplify the prime need for understanding the market in which the commercialisation is to take place. Not only must the market be understood, but also the personal needs of the ultimate consumer. Furthermore, the time factors of the development of the market need to be appreciated - Research results too late may be wasted, achieved too early are wasteful of resource; a quick approximate answer may often be vastly more valuable than the perfect analysis a year later. The relationship between timeliness of research results and the authority of these results is one of the more difficult for scientific management to master.

What then has Industry to offer UNIDO on Commercialisation of Research Results? The principal finding from experience lies in the organisational field. Although every major company has an individual organisation structure owing much to history and a little to geography, there are nevertheless many common features as has been found in course of studies initiated by M.I.R.M.A. (6). The key to successful - or at least working - organisations lies in the communications pathways and it is on these that attention will be concentrated.

Research cannot be economically commercialised without thorough understanding by both parties of the situation and objectives of the other. This provides both the motivation to work and communicate and the means to do so effectively. The demands of this two-way communication process can place strains on the structure of the organisation, be it country or company, which will soon show the weak links.

The Research Institutes operated by the British Government have formalised the process in what is known as the 'customer-contractor relationship' (7), which in essence is what business has always recognised. The practical problem is to establish this relationship without upsetting the essential pride and creativity of the research body. It also forces a discipline of strategic thinking on the 'customer' - the business end - which is far removed from short-term entrepreneurial opportunism and the day-to-day pressures from the ultimate consumer - the public-at-large.

II THE MATRIX

This relationship can only be fruitful if the material and psychological needs of the Research resource and those of Commerce are clearly seen as complementary and not competitive. This duality can be expressed diagrammatically as a matrix or seen philosophically as a dialectical situation. It matters not as long as the duality is recognized and communications structured accordingly.

Despite the lack of an accepted formal definition, and occasional divergences of viewpoint in the literature, there is nevertheless a fair measure of agreement, among authors who use the term, about the essential character of matrix organisation. It is seen as a mixed organisational form in which the normal hierarchical structure (usually depicted vertically) is overlaid by a lateral or project structure running horizontally.

The matrix thus presents the organisation in a form which shows the resources available in appropriate functional groupings represented by the columns and the uses to which that resource is put, represented by projects or business areas, in overlying rows.

This presentation recognizes publicly the distinction between the executive management and maintenance of the resource and the co-ordination of its parts in a work situation. Recognition of the duality enhances the rôles of both line (vertical) management and project (horizontal) management and avoids hidden conflicts of rôles. It may however make these possible conflicts more visible by appearing to set the rôles in competition.

In reality the duality of resource management and use-of-resource management is a commonplace and trivial instances abound. An analogy found most useful in talking to scientists is that of a small transport business, a garage, owning a few trucks and cars and operating hire and contract services. The vertical manager - the garage manager - has the task of maintaining the resource: keeping the fleet in good running order, serviced, filled with petrol; keeping up drivers' standards of skill, recruiting and training them and also the mechanics; from time to time altering his resource by buying a newer, more suitable, vehicle or more vehicles, or disposing of a vehicle. The horizontal manager - the

contracts or shipping manager - has the task of making best use of the resource to meet customers' requirements and of adapting his trade to best use of the resource: not to so arrange things that the 5-ton truck is used to collect a roll of film or the limousine the only transport available to collect a load of fish.

Of course, in a very small organisation these are the same man, but this should not obscure the two different rôles and in daily domestic practice does not. In a large and complicated system, it helps to indicate the separation more clearly and this the use of the matrix does.

Even in a complex system, simplicity can be achieved by denying the duality. Planning structures can be established which operate only with, by and through the line management. Many factory operations can be and are conducted this way and most administrative operations also. To meet the needs of the organisation various hybrids of line and staff structures can be established, most of which have their own problems.

Project structures can be established which put all the power into the horizontal rôle and, no doubt for some purposes, these may be admirable. But not for a continuing business. The lack of power, prestige and motivation among the resource management is fatal to continuity of the resource. The corresponding danger of the simple vertical structure is the exact counterpart, namely lack of control of the use of resource resulting in idle resource or misused resource.

Those considerations are of general application and will be found widely discussed in the literature already available. Matrix management in fact is not only highly applicable to Research, but also essential for any substantial and complex industrial or national research organisation.

The matrix presentation provides a clear distinction between the two communication pathways, the 'science and technology' route for reporting and publicising the progress made in the knowledge base of the research resource and 'business' route for supplying to the operating side of the Concern the useful and usable information for the supply of which the research facility was in the first place established. This clear distinction if properly understood greatly eases problems of correct documentation, but does place some additional and potentially rewarding

demands on scientists in management positions.

Elsewhere (8) the plusses and minuses have been summarized to the following effect:-

Advantages of the matrix structure include:

- 1) Defines communication pathways
- 2) Decreases reporting problems
- 3) Provides a framework for objectives
- 4) Provides continuity of professional motivation
- 5) Retains cost locations for efficient control
- 6) Provides project costs from same data
- 7) Develops scientist management with a feel for business.

Disadvantages include:

- 1) Need for 'two-headed' men in key positions
- 2) Puts a load on the lower line management
- 3) Needs sophisticated 'clients' to exploit efficiently
- 4) Causes occasional schizophrenia
- 5) Makes unusual demands on the Head of the Research Institute.

On balance, the matrix type of management introduces a new level of flexibility and control and has great potential as a system in many situations, even if only adopted conceptually and not fully exploited.

III COMMUNICATIONS

The message is that the science and technology resource, the Institute, must be strong and proud and also that its strength and pride should lie principally in the areas of vital scientific and technological need for to-day and for to-morrow. These strengths should be such that they can be used to best effect by a commercial outlet which knows its areas of vital need. There must be equal - and justified - pride in the scientific resource and in the commercial skills and judgments, otherwise the duality is out of balance. Herein may lie the root of some of the failures or poor effectiveness.

... between all principals is essential but that trust and respect are essential components. There is admittedly a certain need for regular communications in the fields of Planning, Management, Information and Reporting, but without the trust the formalities produce empty papers. Communication is too often seen as only an issue of giving knowledge or asking questions - but reception is just as much a part of the process. A radio transmitting station is no good without receiving sets and a dialogue cannot be established without both parties being capable of sending and receiving.

In practice this demands certain procedures best illustrated in matrix terms. 'Vertically' internal reports are issued, written by scientists for scientists. These record the scientific (or technological) progress made in the field over say 6 months and are from time to time collated in a review document. Other 'vertical' output is of course publication in learned journals and papers.

'Horizontal' output comes in many forms, project reports, memoranda, advice, formulae, process modifications, etc., but all should be linked to a project, preferably numbered and recorded. The problem here is that the form and timing of documentation is necessarily and correctly heavily influenced by the 'customer' and therefore less easily regulated by Research.

Furthermore the necessary and correct commercial pressure for useful output in the right form and at the right time may adversely affect the output of vertical documentation recording the progress made in the state-of-the-art scientifically.

The reconciliation of these needs and pressures so that they are seen not as conflicting but as necessarily complementary is a major problem but one worth a lot of attention. Not only is 'vertical' documentation an important element in morale, but also it is vital for archival purposes. As individuals come and go, reinventing the bicycle is a continued threat; new staff need to be able to read what has been done in the past in the specialised fields in which they will work, not just the published literature, if any, but what their predecessors have done or not done.

IV. EXAMPLES OF COMMERCIALISATION OF RESEARCH RESULTS

Clearly, examples abound, since hardly a product on the market contains no element of research contribution and many products owe their whole commercial existence to research findings. However, the definition of cases where the long-term 'institute-research' approach resulted in commercialisation is more difficult; this is because of the contrast between the essential continuity of the research programme and the discontinuity of the actual impact on the market.

The latter category is best illustrated by the work of the company laboratory in Bombay, although there are other examples of work carried out in Europe for the benefit of overseas companies. The Bombay laboratory is managed and funded in the interests of the Indian associate company, operating in its Indian national environment. This means that their research portfolio emphasises import substitution and the development of new exportable goods.

In India the commercialisation of minor oils (kusum, rice bran, neem, karamja, sal, etc.) as economically profitable and technically satisfactory replacements in soap-making for edible oils has been outstandingly successful. The new process for treating castor oil so as to replace imported tallow has been rapidly adopted. The necessary research programmes were undertaken following surveys of need and potential resource which antedated commercialisation by some five years.

The establishment of the research resource, however, had to take place many years earlier still and the build-up in this particular area of oils and fats started in 1963.

In such project areas, the synergy between the commercial side and research is very high and this particular laboratory has a stream of successes to celebrate. Their circumstances are peculiarly favourable to this type of operation and similar achievements are not to be expected everywhere.

Nevertheless valuable results can be obtained in less favourable circumstances - such as wide separation of two parties. A centralised

agricultural research, particularly in the field of crop developments at far removed centres, for example, Siam, where growing has been encouraged since Mexico, and etc. The industrial research laboratory is giving an amount of service to others rather than directly commercialising.

An interesting failure was a product to reduce dental decay - a tablet to be sucked after meals. Technically a success, the product was clinically tested to a strict standard, it was capable of large-scale manufacture and was launched on the market with fully adequate advertising and distributive support. But it failed to be accepted by the consumer. Many reasons were offered, but the most likely is an under-estimation of the difficulty of introducing a new medicine when the effect of the treatment was not immediately perceived. The product was successfully commercialised - however it was not commercially successful!

V. RECOMMENDATIONS

A number of recommendations can be extracted from the experience quoted. Methods of applying these will obviously differ according to the needs of the country and the managerial resources available. However, the principles are valid everywhere and will often be found to be at least partially already practised. Nevertheless a little additional discipline brings considerable rewards.

Recommendations

1. The body or bodies responsible for Commercialisation should have, at the highest level, a senior member with a scientific background who can be a receiver of research information and a transmitter of commercial needs. This very roughly corresponds to the Chief Scientist role in British Government Departments or the R & D Manager in Industry Groups.
2. The Heads of Research Institutes must be very well briefed by the above bodies with their probable future needs and particularly with realistic time scales for, and values of,

research results. A formal system of project policy setting is necessary, preferably on a semi-regular basis. Only by this means can the situation of the Institute be correctly balanced and the work concentrated where it need be, adaptable where it need not.

3. Whilst the heads of research institutes must be uniquely responsible for the quality of the scientific and technology resources in their Institutes, they must accept a great deal of direction from the Business side as to how that resource is used.

A formal Project system is strongly recommended since thereby a control element can be introduced - simple or sophisticated as required - and the Institute can add to its professional pride, a pride in completing projects of stated necessity.

4. A matrix system of Research Management is recommended to meet these needs.

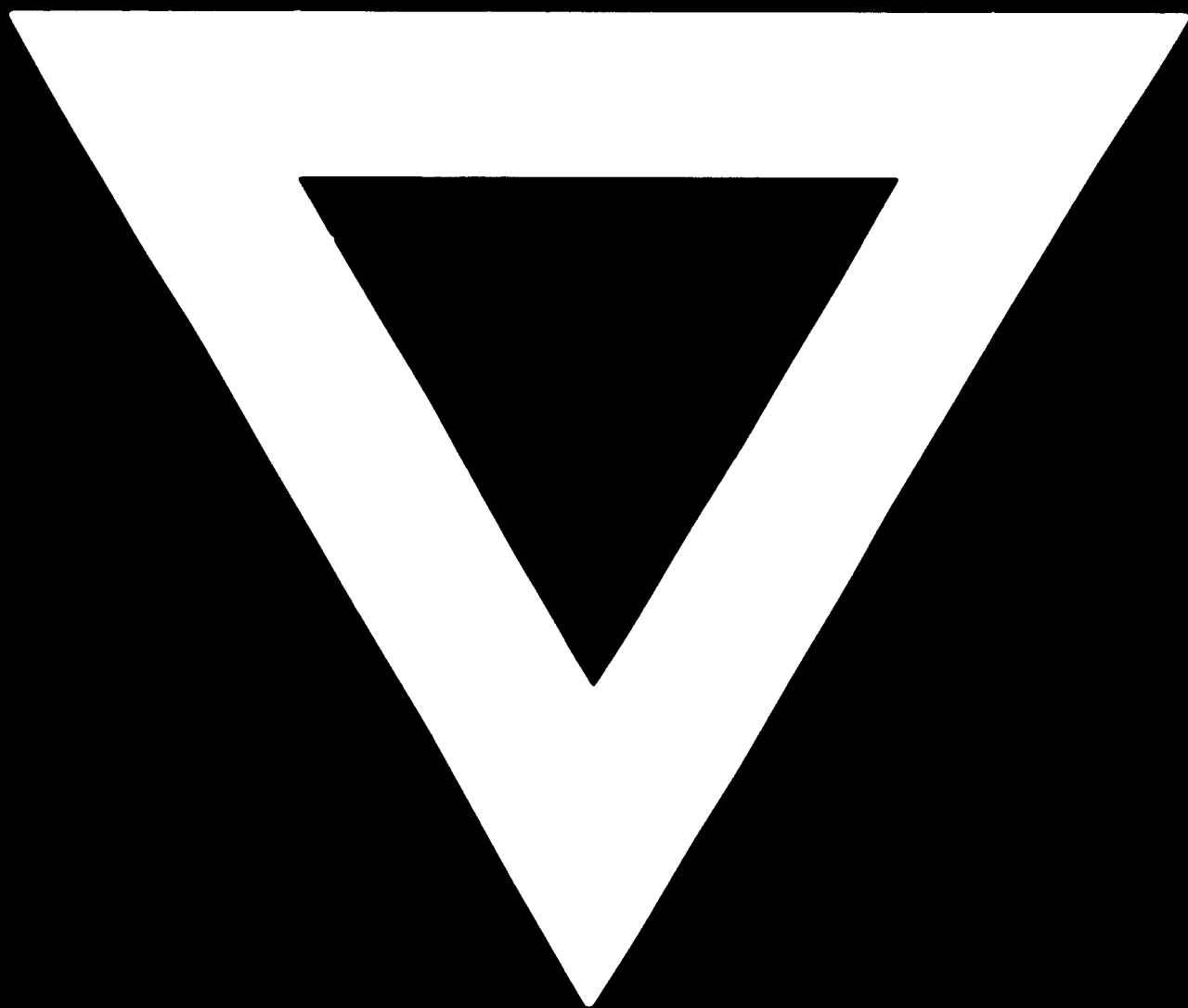
5. The Institute must be prepared to report (communicate) in two modes - one to its 'customers' who in principle supply both the money and the questions - one to the scientific world to ensure that its professional standards are maintained at the necessary level. Both forms of 'reporting' should themselves be monitored as evidence of requisite quality of output.

- 1 -

REFERENCES

- (1) **The Role of Multinational Corporations in the ECAFE Region (Economic Commission for Asia and the Far East, 1973)** - pp. 10-11.
- (2) **Industrial Research Institutions: Guidelines for Evaluation** - UNIDO, E.P. 1974.
- (3) See Ref. (1) - pp. 10-11.
- (4) **Worldwide Directory of R & D** - 1978.
- (5) e.g. **Africa** - Report of the UNCTAD - 1974.
- (6) **European Industrial Research Management Association**, 38 cours Albert-Ler, 75008 Paris: Most reports are only available to members, but some are published.
- (7) **A Framework for Government Research and Development**: HMSO, Ref: Cmd. 4314, 1971, pp. 5-9.
- (8) **wilkinson J.B. (1974). Management Structure in an Industrial Research Laboratory.** R & D Management, 4, 3, 1974, pp. 135-139.
- (9) **Illustrated Weekly of India** - 26.8.1975.





76.01.16