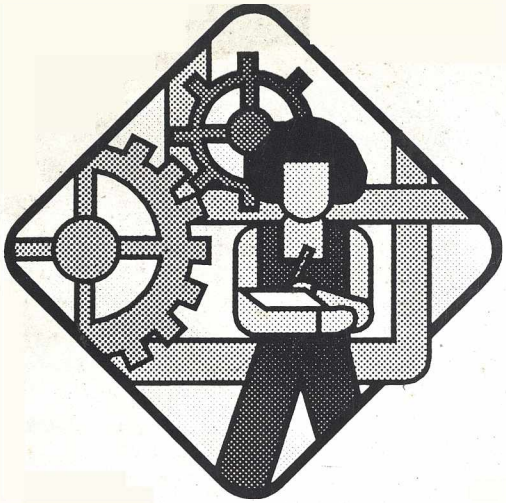

RESTRUCTURING OF RESEARCH AND DEVELOPMENT SERVICES IN THE CENTRAL GOVERNMENT : AN EVALUATION OF PAY AND PERFORMANCE REWARD SYSTEM

Project sponsored by
Department of Science and Technology
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Principal Investigator :
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"It is enough to check the growth of science that efforts and labours in this field go unrewarded"

---Francis Bacon

Contents

Preface

Scientists and engineers engaged in research and development works are a crucial resource of a country. In the new era of harsh WTO regulation and realities of IPR regimes, skilled and well-motivated R & D manpower plays a very crucial role in national prosperity and sovereignty. An appropriate pay and reward system is an essential prerequisite to ensure a steady flow of quality manpower in this profession.

The need for a study on the career of R & D professionals was fist felt during 1990-95 when the present Principal Investigator was a Ph.D. student in the Department of Management Studies of Indian Institute of Science (I.I.Sc), Bangalore and was groping for a topic to write his dissertation. Dr K. B. Akhilesh, Associate Professor, Department of Management Studies, Indian Institute of Science, Bangalore, suggested that since I had studied Physics in my undergraduate and Post-Graduate, it might be a good idea to look into the career of R & D Professionals in India. This suggestion culminated into a thesis titled " Pay, Promotion and Pay Satisfaction of R & D Personnel in some Indian Manufacturing Organisations" in 1995 which mainly dealt with the career of R & D professionals in public sector undertakings. In April 1995, towards the end of my academic career in I.I.Sc, Dr Akhilesh got a research proposal from the Fifth Central Pay Commission Committee to do a study on the Career of R & D Professionals in the Institutional Sector with Dr K. B. Akhileshh as Principal Investigator, Dr. K. Chandrasekhar of Department of Management Studies, I.I.Sc, Bangalore as Co-Investigator and the Present Principal Investigator as Project Officer. However, before the project could take off the present Principal Investigator left I.I.Sc and joined Vinod Gupta School of Management, Indian Institute of Technology, Kharagpur as Assistant Professor. Because Fifth Pay Commission wanted the results within six months, Dr Akhilesh reduced the scope of the project and completed the project with a smaller sample. After joining Vinod Gupta School of Management, the present Principal Investigator wrote a fresh proposal to Department of Science and Technology (DST) of Government of India, on the need for a comprehensive analysis of pay and reward system for R & D professionals in the Government sector. He took Dr Kalyan Guin, Associate Professor, Vinod Gupta School of Management, I. I. T. Kharagpur as Co-Investigator to this project. By the time the proposal came for presentation to Project Advisory

Committee (PAC) of DST in June 1996, the Fifth Pay Commission has completed its studies and the issue of career of R & D professionals was no longer a hotly demanded subject. During proposal presentation and expert evaluation several members of the Project Advisory Committee of DST raised this question on the utility of this study. But they all agreed on two points; one; that a study on the career of R & D professionals was very much necessary in the new WTO & IPR enforced regime; two; that a study on the career of R & D professionals in the Public Sector system was just completed by the Principal Investigator (PI) and the present study may be a good complement to the previous one. Thus inspite of the lack of urgency from Pay Commission or any other agency, the PAC appreciated the need for a comprehensive analysis on the career and reward for R & D professionals in India to make R & D an important occupation in the country. They granted the project with a reduced time frame of one year and reduced scope of studying only five laboratories instead of twelve laboratories of the original proposal.

By the time the project was finally cleared by the PAC of DST, the PI moved to Indian Institute of Management Calcutta as Visiting Assistant Professor. This change of institution necessitated a resubmission of the Project with a new set of Project Teams. Because of long distance between I.I.T. Kharagpur and I.I.M. Calcutta, it was felt that keeping Dr Kalyan Guin as Co-Investigator would not serve any useful purpose. Thus a new set of team with Dr (Mrs) Ujvala Rajadhyksa, Visiting Assistant Professor in the Behavioural Science group of I.I.M. Calcutta as Co-investigator was proposed. The final sanction of the project with revised time and budget was granted in March 1997.

Work on the project started in earnest only in April 1997. However, after working on the Project for six months it was apparent that the project could not be completed in one year by any means. Quite a few of the organisation that was contacted were either not sending any reply or were reluctant to part with their personnel records for fear of litigation. Some organisations even though agreed to participate could not provide the data right away because it was not available in a readily available form. They wanted sometime to prepare this data. DST was promptly apprised over these ground realities. They agreed on the need for extension but wanted some progress before the end of the year. Towards the end of the fist year, DST advised to form a local project advisory

committee to monitor progress of the project. Accordingly, a Local Project Advisory Committee (LPAC) consisting of experts from academics, institutional sector R & D, public and private sector industries was formed in January 1998. The details of the members of the Local Project Advisory Committee are given in Appendix-D.

Towards the end of the first year one of the five laboratories which so far had not sent any reply to our repeated request suddenly sent a negative reply. They replied that though they were supportive of the study but could not be part of the study because they felt it was redundant as the Fifth Pay Commission has already finalised its report. DST was informed about this development and a meeting was held in Delhi about what to do; whether to go for another different department or just complete the study with only four laboratories that have already agreed to the study. After some deliberation and discussion, it was decided that since one year has already passed starting afresh with a new department would prolong the study by a couple of years. Thus it was agreed that the study would continue with only four laboratories of one each from four Departments of the Government that had already communicated their willingness to be a part of it.

The first meeting of the Local Project Advisory Committee (LPAC) was held in Calcutta on March 7, 1998. DST was represented by Dr G. J. Samathanam, PSO, NSTMIS division. By that time data from three organisations were received and the fourth organisation agreed to participate but the data was yet to be received. Accordingly, the project was extended by six months till September 1998.

The second meeting of LPAC was held on 8th July 1998 in Calcutta. Dr Samathanam represented DST in this meeting. The PI presented the progress made and was sure to complete the project by September. However, data from one organisation appeared very inconsistent and required clarification and fresh data. Since the project scope was already reduced from five to four laboratories, it was felt that completing the project without the corrected data from one more labs would affect the quality of the report. The matter was put to LPAC members and they agreed that some more time may be given to PI so that this data can be corrected. Accordingly the project was extended by three more months till December 1998. Dr Smathanam was also wanted to see if he could use his connection and good office to get additional data from this organisation.

Inspite of all our attempts and personal visit this data was not forthcoming. The problem was that this data was not available in any single place in this laboratory in a readily readable form. Someone had to work by hand to prepare this corrected data sheet. Thanks to old boy's connection of Dr Samathanam ! He was quite successful in engaging someone in this task and getting this data sheet ready in a month. The corrected data sheet was finally received in January 1999. On obvious reasons the project was once more extended by three more months till the end of March 1999.

Towards the end of the project period, Co-Investigator Dr (Mrs) Ujvala Rajadhyksha quit her job at I.I.M. Calcutta and joined I.I. T. Bombay. However, because she was not very much involved in the activities of the project from the beginning, her departure did not create much of a problem in preparing the final report. The final report was completed in April 1999.

This report summarises the total work of two years with input from four major laboratories from four different department of the government. The report has touched on various issues related to pay, performance appraisal and recognition and career of R & D professionals in Government sector. The study indicated that inspite of so much investment and involving the career of so many highly skilled professionals, there was very little attempt to develop an appropriate human resource policies to improve quality of work environment of the R & D organisations in Government Sector. The report includes an executive summary, a chapter on concluding remarks with recommendation for policy modifications. The various Chapters are as follows: Introduction (Chapter-1), Literature Review (Chapter-2), Scope and Methodology (Chapter-3), Results (Chapter-4), A study on Past Pay Commission and Career of Scientists (Chapter-5), Career of R & D Scientists in other countries (Chapter-6), Concluding Remarks and Recommendations(Chapter-7).

We hope the scientific and technical professionals in general and science policy makers of the country in particular would find the study interesting and useful.

Dr Pulak Kumar Das

April 18, 1999

Acknowledgement

It is difficult to find words to express thanks and gratitude for the encouragement and support received from various sources at different phases from inception to completion of this project. First, and foremost, I would like to express my sincere gratitude to the Department of Science and Technology, Government of India for their enthusiasms and support to this study. Dr A.N.N. Murthy, Former Head, NSTMIS division of DST was very enthusiastic about the project from the very beginning. Mr Rakesh Chetal, Director, NSTMIS division DST who was responsible for monitoring of the project in the beginning provided much needed support and encouragement to overcome some of the critical start up hurdles in this project. Dr Laxman Prasad, Head, NSTMIS division has been very understanding to the practical difficulties of executing such a multi-organisational project and completing in time.

I owe a special debt to Dr G. J. Samathanam, Principal Scientific Officer, NSTMIS division of DST for his constant support and encouragement during the entire period of the project. He has not only monitored the progress of the project but also took personal interest to make sure that all the necessary inputs are available in time. He has participated actively in all the Local Project advisory Committee (LPAC) meetings held in Calcutta and has taken considerable pain in clearing doubts of some of the LPAC members.

I am particularly grateful to Prof. Subir Choudhury, Former Director, Indian Institute of Management Calcutta for allowing me to conduct the study in IIM Calcutta. I am thankful to Prof. Amitava Bose, Director, I.I.M. Calcutta for his keen interest in the project and his desire to see that the project is completed without any hitch.

I am grateful to Prof. Amitava Bagchi, Professor, MIS group and member of the Board of Governor, I. I. M. Calcutta who inspite of his extremely busy schedule accepted my request to be a member of the Local Project Advisory Committee and attended all the meetings held in Calcutta and participated very actively in all the LPAC meeting and took personal interest to see that the project is completed in time.

I owe a heavy debt to Dr H. S. Maiti, Director (Acting), Central Glass and Ceramic Research Institute, Calcutta who inspite of his very tight schedule, accepted our invitation to be a member of the LPAC and participated actively in one of the LPAC meeting held in Calcutta. Thanks are also due to Mr S. K. Ghosh, Deputy Director, Central Glass and Ceramic Research Institute who obliged to our request to participate in one of the LPAC meeting held in Calcutta.

I would like to thank Dr S. K. Mittal, Director (R & D), Exide India Ltd, Calcutta, who accepted our invitation to be a member of the LPAC and took personal interest in the project matters and provided quite a good amount of valuable advice in the project.

Thanks are due to Dr (Major) N. G. Kannan, General Manager (HR), Indian Oil Corporation Ltd., Calcutta for his constant interest in the project and for active participation in two LPAC meetings held in Calcutta.

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I would like to thank Prof. Kalyan Guin, Associate Professor, Vinod Gupta School of Management, Indian Institute of Technology, Kharagpur who was Co-Investigator in the inception stage of this project. A special thanks is due to Dr (Mrs.) Ujvala Rajadhyksha who agreed to be a Co-Investigator when long distance between IIM Calcutta and IIT, Kharagpur made it difficult to communicate on a regular basis with Prof. Kalyan Guin. And, the Principal Investigator felt the need for a local co-investigator

for the project. Thanks are due to Mr Amal Saha who as Project Assistant took the burden of computation and analysis of massive data without any qualm. Without his skilled analysis this project would have never been completed ! My secretary Sri Biswajit Dutta did an excellent job in typing a few chapters of the final report.

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There have been a few professors, scientists and Corporate Managers working in other countries who have been associated and have contributed valuable documents and data to this project. Special thanks are due to Dr Seoung Youn Kim, Scientists, Electronics and Telecommunication Research Institute, Taejon, South Korea; Prof. Tim Turpin, Centre for Research Policy, University of Wollongong, New South Wales, Australia; Dr Ta-Yan Leong, Manager, CSIRO, Australia; Dr Tony Neidermier, Manager, CSIRO, Australia; Prof. Eliezer Geisler, Department of Management, College of Business & Economics, University of Wisconsin, Whitewater, Wisconsin, USA; Professor Michel E. Domsch, Institute fur Personalwesen und Internationale Management, University der Bundeswehr, Hamburg, Germany; Professor George Haour, Professor of Technology Management, International Institute for Management Development, Lousanne, Switzerland; Professor Young Bae Kim, OB Lab, Graduate School of Management, Korea Advanced Institute of Science and Technology, Seoul, South Korea.

Last but not the least important partners to this project are the Head of the laboratories and their staff and officers who participated and provided all varieties of important information and data to make it a successful project. Due to need to maintain anonymity we shall not be able to thank all of them by name. A few of them whose contribution is more than mere data supply and who indicated no particular hesitation in identifying them would be mentioned. First and foremost, I would like to thank Dr. T. S.

Prahlad, Director, NAL Bangalore, whose very encouraging reply to my first letter, provided the much needed support to overcome the initial frustration of making contact with the organisations. Dr S. Bhogle, Scientists and Head (Information Service), NAL was more than a mere organisational co-ordinator. Without his personal interest and work this study would have never been complete. I do not have words to express my gratitude to Dr G. M. Cleetus, Director, LRDE, Bangalore, Mr K. Vishnu Vardhana Rao, Director, Electronics and Instrumentation, Defence Research and Development Organisation (DRDO), New Delhi and Sri, Y. V. L. N. Rao, Additional Director, LRDE, Bangalore for their kind and memorable hospitality. I am particularly indebted to Dr R. B. Singh, Director, IARI, New Delhi for his frank and positive reply to our request to do the study in his laboratory. I owe a special debt to Dr K. K. Choudhury, Head (Bio-Informatics), IARI, New Delhi and Dr. D. K. Mitra, Principal Scientists, Incharge (Planning & Information Unit), IARI, New Delhi for their timely support to get a computerised data base for their organisation.

There are many others who directly or indirectly had been associated and contributed to the successful completion of this project. Their sheer number prevents me from acknowledging them by name. Nevertheless my debt to them is no less than to others.

Executive Summary

In an open liberalised environment, R & D professionals play a very very crucial role. A country can achieve competitive advantage on a sustainable basis when it has sufficient number of well-qualified and dedicated research workers. In order to attract better quality professionals into R & D services and to retain them in this occupation, it needs an appropriate human resource policy to recruit and develop them and recognise them for their contribution towards technological innovation.

A study was conducted on four laboratories from four different departments of the Government to understand existing recruitment, pay, performance appraisal, reward and recognition policies and the level of turnover of scientists experienced by these laboratories in recent past. Data for all the currently working scientists were collected from these laboratories, which was also supplemented by primary data collected by a questionnaire survey on a sample of scientists.

Data was analysed on the following 14 aspects related to the career of scientists in these laboratories viz. recruitment policies, performance appraisal system, promotion policies, structure of current manpower, career competitiveness across organisations, career of differently qualified professionals, career of lateral entry recruits, characteristics and career of recent recruits of last five years, existence of fast track, effects of performance appraisal scores on promotion, nature of turnover of scientists in last five years, nature of performance appraisal scores, existence and use of non-promotion types of awards, treatment of research services by the Central Pay Commission.

Our analysis of recruitment policies for R & D professionals indicated the existence of a non-competitive starting pay in these labs. The treatment of higher academic qualifications and work experience were quite different in different labs

The existing performance appraisal system in these labs suffered from a structural weakness of poor guideline on evaluation scale to appraiser, low communication between appraiser and appraisee and very often unclear and unknown relations between performance and reward.

Analysis of promotion policies showed there was no special policy to bring more qualified people in higher levels. Some laboratories linked minimum service requirement for promotion with performance but not with educational qualifications. Except in one lab, in general the financial incentive for superior performance was more than a corresponding incentive for educational qualifications above the basic degree.

Our analyses of current manpower indicated almost all the labs suffered from the shortage of qualified manpower. The median age of current manpower was quite high in a few labs. The rate of recruitment of these labs fell far short of their normal replacement requirement on account of superannuation.

Our analysis of career outcome of grade and salary across organisations indicated the existence of non-competitive career both in the first stage as well as in the late career of the professionals. The average financial incentives for educational qualifications above the basic degree were also quite different in different labs. The effect of work experience prior to joining the organisation on current basic salary was considerably less than a corresponding experience acquired from within the organisation.

Analysis of career of differently qualified professionals indicated that in most labs, the percentage of professionals who acquired higher academic qualifications after joining was quite low indicating a poor desire on the part of the professionals to take the trouble. It could be due to poor compensation policy and practice for additional investment in education over and above that required to get a job in these laboratories. The difference in average salary in the first stage of career between professionals with Bachelors, Masters and Ph.D. were too small to compensate for the opportunity cost and psychic cost of acquiring the higher academic degrees.

On the efficiency of the labs in recruiting experienced professionals from the market, we found lateral entry as a percentage of total number of scientists was moderate in all the four labs. The lateral entry recruits experienced some advantages in initial pay when their mobility experience was combined with higher academic qualification.

Except in one lab, recent recruits of last five years were found to be less qualified than the current manpower in all the labs. The average age of entry of the recent recruits

were higher than those who joined before indicating that possibly more experienced professionals were joining now.

On the existence of fast track career, we found in a few labs there were evidence of fast track career in the sense that two or more promotions at the shortest possible time were achieved in a row. Though such incidents were becoming quite rare now. Along with evidence of fast track career there was good percentage of professionals who missed their normal promotions two times in a row.

On the effects of performance appraisal score, education and work experience on probability of promotion, we found relative effect of work experience in current grade on the probability of promotion was more than that due to either a higher academic qualification or one point rise in performance appraisal score.

On the nature of turnover of scientists and engineer in last five years, we found there was serious imbalance between rate of recruitment and rate of loss of manpower by resignation in a few laboratories. In most of these laboratories, the rate of recruitment just balances the rate of loss of manpower by resignation. A few laboratories were loosing more qualified manpower by way of resignation than what they could recruit. Voluntary resignation took place mostly from either the first or the second grade. Those who left were not necessarily the slow movers in the hierarchy !

We found performances of scientists were influenced by their educational qualifications, by their current grade and by the career stage at which they joined the organisation. Professionals with higher academic qualifications had better appraisal scores than those with lower qualifications. By and large scientists working in higher grade had higher appraisal scores than those in lower grades. In general lateral entry scientists and engineers had higher appraisal scores than the fresh recruits. It was farther observed that those who missed their normal promotions two times in a row were not necessarily poor performers. Quite a good percentage of them had appraisal scores at the highest point of the scale !

We found in all the laboratories there were only a few non-promotion types of awards for recognising performance of the scientists. Worse still was that even when a few of such awards were available, they were not used very frequently to recognise superior performance nor was their any attempt to publicise their existence.

A few of the recently concluded Central Pay Commissions had indeed gone into the issue of a separate career development scheme for R & D professionals. It recognised the special types of jobs done by research workers and recommended the use of faster promotion scheme for R & D professionals genuinely engaged in research work- a modified form of dual ladder scheme. However, the scheme was poor on the operational side may be due to lack of enough research data on career orientation of research workers in India. In terms of pay structure, there was poor appreciation of differential learning and career aspirations of R & D professionals doing innovative research works and ordinary engineering workers doing routine jobs.

Based on our findings and survey of published literature and collected documents from other countries we made the following recommendation to make R & D occupation in Government sector a more attractive and rewarding profession.

Our first recommendation is to identify an R & D laboratory on a Technology or Innovation Scale based on certain parameters. Some of these suggested parameters could be nature of research projects undertaken in recent past,, project duration, project structure in terms of number of people involved and project outcome in terms of new concept, new product, new process, technology transferred to industry etc. A second point to note is the structure of operational budget. How the allocations are going towards research and towards development. Third issue to note is the availability of professional recognition to the research staff. To what extent their individual activities are known to the public at large. To what extent the social and professional modes of recognition are blocked on strategic grounds. In situations with highly inactive professional and social recognition mode, the organisation may have to devise alternative means to compensate the scientists.

The pay structure for the scientists working in a laboratory should reflect its position in the continuum identified in the previous paragraph. ***Higher entry level pay with faster rate of career growth in the first career stage are desirable in laboratories with highly innovative product or process and very long run oriented research.*** *The duration of the fast growth could be decided based on average time required to establish well in the job. In the second phase recognition issue is much more important than compensation issues.*

Rewards for good performance can be in the form of promotion to next higher grade or multiple increments in the same grade. Promotion to next higher grade involves evaluation of both the current performance as well as potential performance for the next level. Those whose current performances are high but potential performances are low, may be given an appropriate number of multiple increments as a recognition of their performance. This will prevent development of frustration and discontent against the promotion policy and the committee.

A non-overlapping fast track pay scale may be developed for very high performers. However, in environment where jobs are most often team oriented, considerable caution must be exercised in its execution lest it disturbs the team spirit. To begin with the scheme can be applied in selected jobs that are more or less "relationship neutral". Once a performance-oriented culture has taken its root, the scheme may be extended to other jobs. In all cases, a visible and easily verifiable performance indicator must be used to place a person on a fast track.

Existing performance appraisal system needs considerable improvement before any innovative reward system can become effective and acceptable to the employees. Some of the areas where it needs urgent attention are: 1) Anchoring the measurement scale against appropriate performance; 2) Bringing developmental orientation in the appraisal; 3) Feedback and counselling process needs improvement to bring more participation from the appraisee; 4) There should be periodic audit of the performance appraisal record to ensure its utility and effectiveness; 5) It is necessary to make the performance appraisal process a 'live' exercise.

Considering that technological complexity demand conceptual understanding, the starting pay and promotion policies should be such that professionals with educational investment above the basic degree should be able to recover the full cost of their differential investment within the first five to ten years of their joining in the organisation. After this period they may be placed at par with others. This policy should be explicit and transparent to all members of the organisation. In organisation working in highly complex and frontier areas of technology, there may be special need for manpower with higher level of formal education. These organisations may consider

linking promotion to higher grades with educational qualification, performance and work experience in the organisation.

In order to encourage more mobility of scientists across different organisations and departments and to attract more specially qualified scientists from outside, it is important to have very clear policy to recruit these specially qualified professionals whose unique skills could not be generated from within the organisation. While setting the initial pay and grades of these professionals, it is important to ensure that their career do not suffer because of their change of organisation. While framing such policy, it is important to consider core activities of the organisation and to what extent individual performance can be considered as "relationship neutral". When jobs are highly team oriented and or people dependent established network may prevent easy entry of outside experts and their success. In such situations extensive and attractive lateral entry policy may not be desirable.

Dual ladder scheme should be implemented in those organisations where there are clear demarcations in types of jobs done by people holding similar ranks but working in different locations. Faster or merit based ladder may be encouraged for those areas where jobs are technology intensive. However, before implementing such a scheme, it is desirable to understand to what extent a distinct and stable career orientations exist among the professionals. And, if it exist, at what point in career there is a convergence in orientation. This will provide information on the number of levels up to which career can be kept separate. Without understanding these expectations a dual ladder scheme may not yield any fruitful result. On the contrary it may spoil the team spirit and organisational climate

More non-promotion type awards should be invented and practised in all R & D organisations. In situations where promotion or other permanent change in status cannot be granted, these non-promotion awards may be given as a recognition for outstanding performance. However, visibility and management commitment in such awards is very crucial to its success. It is also important that there is wide publicity for such awards so that every body knows about it and can work for it.

While adopting a new pay, promotion and incentive policies, it is important to maintain a competitive policy with other R & D organisations that are equally positioned on the innovation and technology scale.

Last but not the least, a comprehensive human resource information system may go a long way towards ensuring success of any kind of strategic restructuring of human resource policies including the reward system.

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Chapter-1:

1.1 Introduction:

We are living in an era of high dependence on scientific knowledge and application of technology. Growing size of population and progressive depletion of natural resources made this dependence all the more critical. Survival and growth of many nations including ours now demand a judicious use of natural resources that are still left using scientific means and by developing newer and cheaper resources by pursuing more intensive and vigorous scientific and technological research. Building indigenous capabilities for developing newer technology or newer uses of existing technologies require a considerable investment in research infrastructure. However, investment in physical infrastructure alone will not suffice. There should be corresponding matching investment in human capital combined with an effective and efficient administrative machinery to develop and administer an appropriate human resource policies to utilise them.

With unstinted political patronage and state support in the form of economic incentives, the country has made a substantial strides in terms of setting the necessary infrastructure for conducting scientific and technological research of immediate and long term interest of its industries. There are a total of 300,000 personnel involved in R & D of which 100,000 employed directly in R & D. The country is spending more than Rs 6800 Crores annually to run these R & D establishments (DST, 1996). As a percentage of our national income, we spend about 0.8% of the GNP in maintaining a viable R & D set up in the country.

1.2. R & D in the Central Sector

Though as a nation we spend as much as Rs 6800 Crores yearly in running different R & D establishments, but most of these cost burden are actually borne by the central government. As much as 79% of the total expenditure are actually borne by the central Government with the remaining 21% shared between various state Governments and private sector industries. The Share of the private sector industries is no more than 16% of the total R & D budget of the country (Research and Development Statistics, 1994-95). These highlights the pivotal role plays by the Central Government not only in providing the necessary research services to the economy, but also setting the pace and tenor on how an R & D establishment should be run in a developing country with limited financial resources to go around.

The percentage share of the Central Govt. has been increasing quite steadily every year. It was 73% in 1992-93 and 75% in 1994-95. In absolute terms the share of the Central Govt. was Rs3664 Crores in 1992-93 and became Rs5113 Crores in 1994-95. The projected expenditure for 1995-96 was Rs5731 Crores. In recent years, the central expenditure has shown an annual growth rate of 12%.

The central Govt. spending in R & D can be classified into 13 major socio-economic objectives with their percentage share as shown in Table-1.2A

It can be seen that defence alone accounts for as much as 29.2% of the total expenditure.

Table-1.2B shows the percentage share of R & D expenditure among major Govt. agencies. This table shows that as much as 82% of total R&D expenditure of Government are channelled through five agencies viz. DRDO, DOS, ICAR, DAE, CSIR of which DRDO alone accounts for 31.7%. This means policies adopted by these agencies and the practices of their administrators will have significant impact on the career, employment and availability of R & D professionals in the country.

Table-1.2A

Percentage share of Central Government R & D expenditure by Objectives 1994-95

Objectives	% Share
Defence	22.1%
Development of Agriculture Forestry and Fishing	17.4%
Promotion of Industrial Development	13.8%
Space	11.2%
Development of Health Services	7.3%
General Advancement of Knowledge	5.9%
Development of Transport and Communication	5.8%
Production, Conservation and Distribution Energy	5.7%
Protection of Environment	4.1%
Others	6.7%
Total	100.0

Source: Research and Development Statistics 1994-95, DST, Government of India

Table-1.2B

Percentage share of R & D expenditure by major scientific agencies 1994-95

Defence Research and Development Organisation (DRDO)	31.7%
Department of Space (DOS)	19.2%
Indian Council of Agricultural Research (ICAR)	11.1%
Department of Atomic Energy (DAE)	10.6%
Council of Scientific and Industrial Research (CSIR)	9.4%
Ministry of Environment (MOEn)	7%
Department of Science and Technology (DST)	5.6%
Department of Biotechnology (DBT)	1.8%
Indian Council of Medical Research (ICMR)	1.2%
Department of Ocean Development (DOD)	1.2%
Department of Electronics (DOE)	1.0%
Ministry of Non-Conventional Energy Sources (MNES)	0.2%
Total	100%

Source: Research and Development Statistics 1994-95, DST, Government of India

1.3 Scientific and Technical Manpower and Employment in R & D Sector

Scientific and technical manpower is one of the most important resources for scientific and technical activities in the country. It is also an indirect index of technical strength of a country. Since independence, the stock of scientific and technical manpower in the country has been growing steadily. At present there are about 6.31 million science and engineering graduates in the country. Between 1991 and 1996, the stock of S & T personnel has grown at an annual rate of 6%. Out of this engineering degree and diploma holders were 0.73 million and 1.2 million respectively. As per the University of Grants Commission estimate during 1989, the annual out turn of S & T personnel from the university system of the country was 2.32 Lakhs.

As of 1994, 3,14,489 S & T personnel were employed in R & D establishments of the country. Out of this 36.4% were primarily engaged in R & D works, 31.4% were performing technical support services and 32.2% were providing administrative or non-technical support. Out of a total of 1,14,403 S & T personnel who are engaged directly in R & D works, 77,113 were employed in the institutionalised or the Government sector and rest 37,290 were employed in the industrial sector. In term of percentage distribution this amounts to 67.4% in the institutional and 32.6% in the industrial sector respectively. Thus a major percentage of the R & D professionals of the country were actually working in the central Government. and providing public service to the entire economy including the defence.

Auxiliary and Administrative Personnel in R & D Establishments

As was noted before, out of 3,14,489 total S & T personnel in R & D, 31.4% were providing auxiliary service while another 32.2% were providing administrative support. Table-1.3A shows the distribution of auxiliary and administrative support personnel in different Govt. agencies. This table shows that for every person working in R & D there are 0.86 persons working as technical support staff and 0.89 persons working as administrative support staff. Further, it is to be noted that this ratio varies from a low of 0.22 in public sector to a high of 2.22 in the Indian Council of Agricultural Research (ICAR) per R & D person. The employment of technical support staff is as high as 2.07

per R & D personnel in DRDO establishments but is as low as 0.42 in the private sector industries. The employment of administrative support staff is as high as 2.22 for every employment of R & D professionals in Indian Council of Agricultural research and as low as 0.22 in the public sector. This is shown in Table-1.3A.

Table-1.3A

Number of auxiliary and administrative personnel per R & D person in 1992.

	Auxiliary	Administrative
Atomic Energy	1.30	1.1
CSIR	1.12	0.49
DRDO	2.07	1.36
ICAR	1.18	2.22
ICMAR	1.72	1.27
Space	1.00	0.95
Other Ministry/ Deptt.	0.86	1.23
State Governments	0.74	1.23
Public Sector	0.63	0.22
Private Sector	0.42	0.29
R & D as a whole	0.86	0.89

Source: Research and Development Statistics 1994-95, DST, Government of India

The overall employment of auxiliary and administrative support staff is more in the institutional sector than those in the industrial sector. This highlights the service orientation of R & D in the institutional sector and their product orientation in the public sector.

Employment in the Central Sector

As of 1994, there were a total of 186,824 personnel employed in the Central Sector. This was 59.4% of total R & D employment in the country. This includes 24, 530 personnel employed in the R & D units of the public sector undertakings.

Out of the total 186,824 personnel working in Central Govt. R & D, 62,011 were engaged primarily in R & D activities which included 48,731 in the Central Govt. institutions and 13,280 personnel working in the in-house R & D units of Public Sector Undertakings. The manpower employed in the R & D establishments of the Central Sectors were either engaged in research and development or were extending technical support for R & D or providing administrative support. In terms of percentage distribution of total R & D employment, 33.2 of total engaged in direct R & D activities, 30.7% were engaged in auxiliary service, and 30.7% engaged in providing administrative support to R & D professionals.

1.4 Quality of Manpower in R & D (DST, 1993)

Table-1.3B

Yearly Availability of S & T Professionals in the Country

	Graduate		Post-Graduate		Doctorates		Total	
	1979	1989	1979	1989	1979	1989	1979	1989
Science	99749	134366	17638	24591	2262	3044	119649	162001
Engineering	18364	28927	3155	4560	506	560	22025	34047
Medicine	15090	17968	3485	5945	----	---	18575	23913
Agriculture & Veterinary	6280	8301	2384	2876	480	792	9144	11969
Total	139483	189562	26662	37972	3248	4396	169393	231930

Source: Research and Development Statistics 1994-95, DST, Government of India

Table 1.3B shows the yearly total availability of S & T personnel with a minimum of a Graduate degree. This table shows that between 1979 and 1989 the availability of S & T personnel have increased by 50. This growth is not just in number but also in quality. In 1979 there were only 15.7% Post-Graduates but in 1989 this percentage increased to 16.4%.

In keeping with the increasing availability of more qualified S & T personnel and with the increasing complexity of technology and research, the quality of manpower in R& D is also increasing at a rapid pace.

Table-1.3C

Academic Qualifications of R & D Professionals (DST, 1993)

Qualification	1988	1992
Ph.D	14.4%	18.1%
Post-Grad.	28.5%	31.0%
Grad.	26.6%	30.3%
Dip.	9.1%	10.1%
Other	21.4%	10.3%

Source: Science and Technology Pocket Data Book 1993, DST, Government of India.

Table-1.3C shows the distribution of academic qualifications of R & D professionals in the country in the year 1988 and 1992. This table shows that the percentage of Ph.D. in 1988 was only 14.4% but has gone up to 18.1% in 1992. The percentage of Post-Grads was 28.5% in 1988. In 1992 this percentage became 31%. It was also observed that the percentage of Ph.D., Masters and Graduates in the R & D sector was much higher than the corresponding percentage of Ph.D., Masters and Graduates engineers in the entire industrial sector. This shows the R & D activities are more human capital intensive than other activities of an industry.

1.5 Career of R & D Professionals in India.

In view of the small pool of R & D manpower, there was hardly any study to look into the career problem of R & D professionals in India. The policies for R & D professionals have been same as that of the other professionals engaged in other functions in the Government.

During 1971 census survey, CSIR collected additional data on the employment and income of scientists and technical professionals in the country. Prasad(1981) made an analysis of this data. This study indicated that in general professionals with academic qualification over and above the basic degree in engineering and science earn as much as 17% more than those with only the basic academic degree. It was further observed that private sector employment and foreign degree pay much more than a Government sectors employment. This observations were further corroborated by DST study later in 1988.

This study indicated that percentage of R & D professionals in the higher income bracket was in the private sector than in the Govt. sector.(DST, 1988-89)

As a part of his Ph.D dissertation Das (1995) made a comprehensive analysis on the pay and promotion of R & D professionals engaged in public sector systems. This study indicated that, all the public sector organisations followed pay scale, recruitment and promotion policies that were identical with that of their production engineers. It was also noted that seniority was the most important criteria in career growth (Das & Akhilesh, 1994, 1996). Financial incentive for higher education above a basic degree in engineering was as little as one fifth of that of one-year experience in the organisation .

On the role of organisational financial reward system, Das & Akhilesh (1996) found that as much as 90% of the variation of salary was due to variation in qualification and work experience in the organisation. This indicated a career and salary policies that were highly dependent on the potential indicators of performance viz. the human capital. There was not much use of the organisational performance appraisal and reward system. It was noted that pay of R & D professionals were internally competitive but was highly insulated from the external market. There was significant difference in average salary between person of same qualification and work experience but working in different public sector organisations both at the entry level as well as at a later point in time.

It was also noted that changing job among the R & D engineers was not an uncommon and unusual phenomena. Though in terms of career prospects a change of job generally slows down one's career growth. As much as one third of the R & D engineers in public sector system had one other job before (Das, 1997). In terms of average grade and salary, generally, professionals who joined with outside work experience had lower average grade and salary compared to those who never worked in any other organisation. Considering the outside work experience as a kind of human capital formation by self-investment, we found such investment actually did not make any significant difference in career. On the contrary it slowed one's career growth vis-à-vis other who never change their job. This further indicated that in general the Govt. sector including the public sector system does not have any policy to induct specially qualified professionals from outside to boost organisational capabilities and climate.

The organisational policy of performance recognition is one of the most important policies affecting the motivation and quality of manpower in an organisation. This is an area that has remained quite neglected over a long time but deserves immediate and serious attention. Models of performance shows that performance of any person including the research scientists is a function of their ability and motivation (Cummings & Schwab, 1973). A satisfactory performance in an R & D environment requires continuous acquisition and accumulation of information from scattered and disparate sources and use that to generate knowledge. An environment that affect motivation to acquire knowledge or utilise it to the need of the organisation is likely to end up with a low quality personnel unwilling or unable to take any risk- so vital for success in research work. Development of research capabilities among the personnel cannot be achieved only by providing the research infrastructure alone. It requires organisational policy to recognise their performance and achievement. These recognition creates the necessary internal demand for higher output and increased effort. It is by creating demand for research results that the organisation can build and develop the corresponding capabilities of its manpower. And, by recognising their performance in the current job it sends the signal that it cares for their scientific and technological contributions.

1.6 Objective of the Study

Based on the above brief introduction on the rationale for a study on the career and rewards received by R & D professionals in India, we have set the objectives of the present studies as follows:

1) To understand nature and types of rewards that exist in the organisation and the frequency of their use;
2) To analyse the effectiveness of the existing performance appraisal system to identify and reward good performers.
3) To evaluate the effectiveness of the existing pay system to attract and retain the services of qualified and quality professionals;
4) To ascertain the nature and pattern of turnover of R & D professionals;
5) To estimate the level of competitiveness in career among professionals across organisations.

Chapter-2: Reviews of Literature

Section 2.1: Characteristics of R & D Environment.

The R & D environment posses characteristics that are sui generis. The personnel in these environment pursue activities to fuse ideas and concepts from diverse sources to produce a new product, process or just an idea that either did not exist before or that is a partial modification of an existing one with more desirable qualities. Because of this pursuit of new things, it faces certain environmental problems that normally do not exist in other functions of the same organisation. Some of the important features of the R & D environment are:

(a) Risky Occupational Choice.

(b) Risky Organisational Investment.

(c) Interdisciplinary and team effort.

(d) 'Flat' organisational structure.

(e) Conflict of goals.

Risky Occupational Choice: The R & D tasks are non-repetitive and go beyond the existing technology of production and product mix of the organisation. The method involves a lot of experimentation and trial and error on both the technical and commercial aspects of the product or the process. Unlike the routine tasks that are well programmed and follows a

tested methodology, the R & D tasks are a plunge into an uncharted territory where the route map is yet to be chalked out and the algorithms are yet to be designed. Even a technical success in the development of a new product or process cannot assure a success for overall R & D project until the crucial marketing issues are also resolved successfully. An R & D developed product can fail at the marketing stage due to relatively new nature of the product or due to significant departure of its mode of production from the established normal standards. The customers or the users may not appreciate the product or the process as much as the inventors do (Jackson, Schuler & Rivero, 1989).

Risky Investment: The products of investment in R & D activities do not always take a tangible shape to be measured or quantified. Many a time the outcome of a research effort remains in the form of an idea or at the most a blue print. The gestation period for this blue print to take the shape of a marketable and profitable product can stretch over long many years. Quite often the social appreciation and market valuation of a new product and process depend on the development and availability of a few other complementary goods from other industries. In order to justify further investment into an R & D venture the industrial organisations need to evaluate the performance and return from its past investment which are yet to deliver any tangible economic benefit to the organisation. The problem can be compounded further, if the financial and other resources of the organisation are quite limited and the level of scientific development and industrial base of the country are quite primitive in nature. Due to such long gestation, the organisations pursuing in-house R & D may face a serious cash flow problem in its day to day operation. Thus to the corporate planners, the demand for investment in R & D can be a matter of extreme risk (Balkin & Gomez-Mejia, 1984).

Interdisciplinary and Team Effort: Unlike the research activities in academic institutions, in-house R & D involve the simultaneous work of many researchers in different areas of science and technology. The development of science and technology have reached a stage where no organisation can hope to pursue a successful product or process development mission without pooling knowledge and resources from different disciplines and organisational functions. By bringing together the knowledge and experience of people from different areas of science, the organisation creates a synergy to further its long term economic and business goals.

Organising a team with members exposed in different scientific disciplines and experienced in different functional areas can pose quite a challenge to the policy makers.

Running a team of such heterogeneous training and expertise inevitably creates certain human problems originating from the mutual gap in understanding and appreciation of different members professional strengths and weaknesses.

Apart from the task of developing mutual understanding and co-operation among the team members, the organisation also need to develop a methodology to measure and reward the performance of the team members. In a team-based production, different members contribute their bit in developing and maturing an idea into a new and marketable product or process. The evaluation of the individuals contribution in such joint effort can be quite hazardous and fraught with the danger of making either an overestimation or an underestimation. In the absence of such measurement, the linkage between the individual contribution and organisational recognition and reward remain quite unsatisfactory. Unsatisfactory reward for performance has been found to be a major demotivating factor within organisation. Individual reaction and response to organisational reward depend on how well one can relate such recognition to one's personal or group action. Thus desired behaviour can be ensured only by linking reward with performance. It has been observed that when jobs are organised according to team assignment, a team performance based reward evokes higher attitudinal and behavioural response than that due to individual performance based reward (Gomez-Mejia & Balkin, 1989). However, a complete departure from individual performance evaluation and recognition can also invite the problem of 'free rider' with its long run behavioural and functional implications.

'Flat' Organisational Structure: The vertically segmented bureaucratic organisational structure has been quite successful in delegating duties and authorities within organisations. The different levels of organisational hierarchy usually posses their distinctive task specialisation with their unique relations to the overall organisational goal.

However, the job characteristics in R & D setting are quite homogeneous both in terms of their activity set and in terms of the necessary skills. Thrusting a bureaucratic style of organisational hierarchy into such homogeneous function can create a communication bottleneck and stifle the individual initiative. Creativity in R & D setting is facilitated by diversity in organisational climate typically found in 'flat' or adaptive hierarchy. Such structures supports dispersion of power and decision making across different levels without affecting the overall goal of the organisation. These structure are more receptive to new ideas and suggestions and nurture a culture of tolerance to non conformity- so common among the R & D professionals.

However, such adaptive hierarchy though desirable from the organisational functional points of view are not very helpful to the personnel managers. The different levels of organisational hierarchy not only provides the functionally independent positions but also provides the opportunity to sort people according to their performance and efficiency. The managerial hierarchy works like a sorting machine to select the best and the most efficient from the group of aspirants (Lazear & Rosen, 1981). Thus the higher level managers are paid more because of the role specialisation and because of the selection process by which these positions are filled. This absence of enough hierarchical levels in the R & D functions further creates the problem of finding an appropriate career for those who would like to continue working in a creative environment. The absence of enough number of levels can lead to either a stagnation in career or at the most a career with promotion linked with a transfer to other non R & D related functions of the organisation. Both these prospects are quite unattractive if not frightening to the R & D professionals who made considerable investment in building their human capital appropriate for an R & D environment. It has been shown that a plateaued career has a strong negative effect on work attitude and perception about performance appraisal system (Das, 1998). It was also observed that perception of subjective plateau has a much more stronger effect on work attitude than that of the objective plateau (Gerpott & Domsch, 1987)

Conflict of goals: By virtue of their extensive training and exposure to the world of knowledge, the R & D personnel build the attitude and interest to identify more with peers and professionals working in other organisations. They seek recognition and appreciation of their work more from the peers and less from the organisational authority. Professionals working in other functions of the organisations are generally of 'local' type who seek to satisfy their growth and self actualisation needs entirely from within the organisation. Due to the creative nature of job and due to constant contact with professionals working in other organisations, the R & D professionals generally are of a 'cosmopolitan' outlook and identify more often with the profession and less with the organisation (Marcus, 1985). They identify more with occupational and professional interest that facilitate their acquisition of knowledge and the process of creativity. This search for recognition from professionals and peers outside one's own organisation can sometimes run counter to the business interest of the organisation. Because the basic raison de etre of in-house R & D is to complement the strategic plans of the organisation,

so this desire to communicate the results and findings of research to others outside the organisation may sometimes run counter to the business interest of the organisation.

Because of the possibility of loosing valuable information to the competitors, the activities and goal of in-house R & D are quite often kept as a closely guarded secret even to members of the same organisation working in other functions. Such secrecy about the activities of the R & D creates a communication gap between the R & D professionals and the professionals working in other functions of the organisation. Thus to a considerable extent a part of the channel of social recognition of professionals who work in-house R & D are blocked due to their unique work setting and its relations to organisational goal. Thus while devising a performance recognition policy, these inherent conflict between the organisational goal and the professional need of the research scientists should be taken into account.

Section 2.2 Need and Aspiration of the R & D Professionals.

The need and aspiration of the R & D professionals develop out of their long association with the professionals in academic environment and through the special nature of the task that they perform within the organisation (Coombs & Rosse, 1992). Some of the unique qualities of these professionals are:

(a) Professionals with deep personal investment in human capital.

(b) A new labour force with high mobility.

(c) Individual with desire for autonomy and self-regulation.

Professionals with deep personal Investment in Human Capital: R & D work require advance training in frontier areas of science and technology. Such advance training can be acquired either through formal academic programs in institution of higher learning or through the process of on the job training in some organisations. However, in most organisations the opportunities and facilities for such on the job training are quite limited. Most of them rely on the academic institutions for their requirement of trained personnel. The R & D personnel need to make a considerable amount of investment in personal human capital to make them appropriately skilled for a research career. Unless the organisational rewards in particular the financial rewards are in conformity with the opportunity cost of acquiring these capital, the decline of the long run supply of qualified manpower cannot be ruled out (McCormick, 1995).

New Labour Force With High Mobility: The necessity of high personal investment in human capital for working in an R & D environment also creates a labour market with perennial

shortage of quality manpower leading to high degree of piracy and turnover (Reynolds, 1982). Further, because of high personal investment in human capital, these professionals start their career with high expectation both in terms of career prospects and in terms of quality of work environment with opportunity to realise one's full potential. And, when the organisation fails to meet these expectations, they seek relocation of their employment rather than go into confrontation with the authority as are often done by other workers.

These relocation of employment is further facilitated by the easy visibility of their performance from outside. Because of the special nature of their job, the R & D professionals need to keep in touch with works and activities of professionals working in similar other organisations. These contacts with outside makes their work and performance known to similar other organisations. As has been shown in a number of studies (Dreher, 1982) when performance is visible to others inside and outside the organisations, the leavers are predominantly the better performers. Thus the R & D functions of the industrial organisations can be perennially plagued with the problem of loosing some of its most productive members if it cannot device ways and means to accommodate their aspirations and expectations. Though due to organisational policy of restricted communication and publication of research findings, the visibility of in-house R & D performance is likely to be less than that in academic environment yet such restrictions can hardly prevent the loss of key personnel. The high inter-organisational mobility combined with low organisational identification makes it necessary that organisational recognition of performance is reasonably competitive across organisations (Das & Akhilesh, 1995).

Professionals orientation with desire for autonomy and self regulation: Because of their long and extensive training in academic environment, R & D professionals build certain critical attitude towards their own works as well as that of others. They develop an inquisitive mind acutely aware of their ignorance in all fields including their own. This inquisitive mental attitude further makes them highly sensitive to both praise or blame in matters of sincerity while relatively insensitive to more worldly and less fundamental matters. Within organisation these individuals manifest high degree of technical competence along with general achievement orientation (Raelin, 1985) They have strong preference to be evaluated for their contribution to development of their discipline rather than the growth of their organisation (Von Glinow, 1985).

It is to be noted that all R & D setting and all who are working in R & D do not satisfy all the conditions and characteristics of and R & D setting and professionals. Some organisations may satisfy some of these characteristics very well while others may fail in some of them. The position of an organisation can be identified in a continuum from very repetitive production oriented plant to a highly innovative creative product oriented laboratory. While designing human resource policies, it is important to identify the position of the organisation in this innovation scale.

Section 2.3: Role of Human Capital in Managing High Tech Organisations

Human resource Management practice constitute investment in human capital. Skill, experience, education and knowledge that people possess constitute the human capital. Although the theory of human capital was originally developed to study the economic value of education (Schultz, 1960) more recently it has been applied to selection, training and compensation and human resource management in general (Cascio, 1991; Wallace & Fray, 1988). As Parnes (1984) noted " It is but a short intellectual hop from the concept of human resource to the economists concept of human capital, for that term refer to the productive capabilities of human beings. More precisely, human capital embraces the abilities and know how of men and women that have been acquired at some cost and that can command a price in the labour market because they are useful in the productive process".

There are several parts to this definition. First of all, skill and knowledge represent capital because they enhance productivity. In other words, people add value to a firm to the extent that they will perform future services. Some of this value is added directly by transforming the firm's product, but much of it is less tangible, consisting of solving problem, co-ordinating work or departments and exercising the judgement in novel situation.

Second, human capital is the result of a firms making deliberate investment either through hiring of certain "individuals' from the market or developing them in-house. These investment via human resource management carry both out of pocket and opportunity cost and are justified only if they produce future returns via increased productivity (Tsang, 1987). Since firms are likely to undertake additional investment up to a point at which the marginal cost equals the marginal return, the value of human capital investment depends on the contribution of employee to a firm. The higher the potential for employee contribution, the more attractive human capital investment will be (Tsang, Rumberger & Levin, 1991).

Third,, human capital commands a price in the market, because it is valuable to other firms. Perhaps more important is that, it is transferable (Parness, 1984). This transferability is the critical difference between human capital and physical capital. Firms do not actually own human capital- it is embodied in the employee who are free within limit to move from one firm to another (Jacoby, 1991). Even, if employee stay with a firm, their contribution depends on their willingness to perform. Therefore control cost or cost of retaining and motivating employee (e.g. wage) must be considered human capital investment as well (Flamholtz & Lacey, 1981).

If human resource management practice are seen as investment in human capital, how are they affected by the changing nature of work place technology. It is important to realise that human capital become economically valuable only when it is manifested in performance. Employee are not valuable in abstract, but rather as a function of the job they perform (Flamholtz, 1979

With increasingly complex technology, the rate of change work place technology and the demand placed on employee are undergoing radical change. Working in this environment would demand greater technical, conceptual, analytical and problem solving skills. In general, these is a trend towards "upskilling" employee into a knowledge worker whose responsibilities involve problem solving (Kern & Schumann, 1990) rather than touch labour whose responsibilities include only physical work. Research has suggested that skilled workers adapt better than unskilled workers as technology changes (Chao & Kozlowski, 1986) and are more capable of making allocative decision.

Section 2.4: Source of Scientists for Recruitment

There have been a few studies dealing with the source of employee for recruitment and the subsequent tenure in the organisation (Decker & Cornelius, 1979). These studies have shown post recruitment behaviour and performance of employee was quite related to how an employee was hired. In a study on 112 research scientist engaged in an industrial lab. Breaugh (1981) found a strong relation between job performance, absenteeism, work attitude and the source through which they were recruited. It showed individual recruited through college placement office and to a lesser extent, those recruited via the newspaper were inferior in performance to individual who made contact based on their own initiative or from professional journal or convention advertisement. In terms of absenteeism, another effect was demonstrated. Those recruited via. Newspaper missed about twice as many days as did those referred to by any of the other sources. It was also observed that college placement recruitment had significantly lower level of job involvement and satisfaction

with supervision than did employee received in other ways. Wanous (1978) posits that individual who posses more accurate and more complete information about a job will be more productive and are satisfied than will individuals who have less accurate and less complete information. He argues that those individuals who have more complete and accurate information will have a clearer view of what the job entails (role clarity) and they will be more likely perform the job well than will be those individuals lacking such information. There have been some renewed interest lately on the effect of experienced hiring Vs college hiring on subsequent job performance of employees (Rynes, Orlitsky & Bretz, 1997). These studies indicated experienced hires were evaluated more highly than new graduates on most characteristics e.g. understanding business competitors, work ethics and personal ethics.

Section 2.5 Reward System for R & D Professionals

A meaningful reward system is essential for getting the best out of the professionals. Various types of rewards are used to motivate technical people. The term reward system is used to refer to a series of inter-related elements; 1) the type of rewards that are available in a firm; 2) the condition under which different rewards are made available to individual employees; 3) the way in which these rewards and the criteria for their allocations are selected and administered in a firm (Sethia & Von Glinow, 1985). There are five distinct classes of rewards salient in high tech organisations.

Financial or Economic Rewards: It is widely believed that money and related finical rewards are the best stimulus to employee performance. These financial rewards include pay, fringe benefits, bonus etc.

Prestige or Social Status Rewards: These rewards bring respect or envy of other people in the firm. It need not have a financial component.

Job Content Rewards: These rewards have more to do with work itself. These rewards allow individual to satisfy important professional needs and goals. Doing important or interesting work or being challenged by the job are these kind of rewards.

Career Rewards: It is more to do with enhancing personal career. These rewards highlight growth, longevity and leaning prospects ex. job security, training and development opportunity for advancement.

Professional Rewards: These rewards have been shown to consistently attract, motivate and retain high tech professionals employee ex. Having autonomy with respect to means and ends decision; freedom from tight supervisory control; ability to pursue continuing education.

What are most valued rewards: Research in organisations e.g. Sun Corporation, ARCO, Rockwell, AT&T etc. indicated the following as the most valued by high tech and professionals workers.

A. Professional Rewards:

i. Opportunity to work with top flight professionals
ii. Freedom to make most of your own work decisions
iii. Intellectually stimulating work environment
iv. Not working on repeating yesterday but working on tomorrow.
v. Having an impact on national legislation

B. Job Content Rewards:

i. A productive atmosphere
ii. Flexible working hours
iii. Long term project stability
iv. Opportunity to address significant human needs
v. Diversity of business, which creates continuing new opportunity
vi. Patriotic projects.
vii. Projects of an altruistic nature

C. Career Rewards

i. Working for a leading edge company
ii. Diverse opportunity for personal growth and advancement
iii. Opportunity to participate in company success
iv. Career opportunity to stay ahead of the crowd
v. Opportunity for self expression
vi. Being able to play a role in company future

D. Social Status or Prestige Rewards

i. Beautiful location
ii. Open door management
iii. Extensive recreational facilities

E. Financial Rewards

i. Twice yearly salary review

ii. Compensation for unused leave

iii. Cash bonus

For professionals, the most important rewards are professional and job content rewards. The value of any reward however changes with change in the career stage. Among scientists and engineers the value , importance, aspiration and satisfaction have been found to change with age and seniority (Hall & Mansfield, 1975). Professionals in their 20's respond better to job content and financial rewards. In 30's responds to professional, career and job content rewards; in 40's respond to professional, career and job content rewards, in 50's respond to social financial and career rewards (Griggs & Manring, 1986; Miller, 1986; Von Glinow, 1985).

While deciding and distributing reward it is important to pay attention to the timeliness of the rewards the transparency of the follows in calculating it (Leptien, 1995).

Research on reward expectation and satisfaction of R & D professionals in Indian Public Sector undertakings indicated a strong desire for cash income and promotion. Gross salary as such doe not have much effect on pay satisfaction. It is cash component of the gross salary or the take home salary that matters in pay satisfaction indicating the strong role of financial pay reference in personal pay satisfaction. It was also observed that company profit based bonus as such have no effect on pay level satisfaction. Such membership-based reward at the most may work as some kind of benefit. Naturally their effect on performance is unlikely to be very significant at the most it can have some effect on reducing turnover intention (Das, 1993; 1996b; 1997)

A recent research in a few high tech company, however, found that though a varieties of rewards are in use, many of them do not yield any meaningful result. Positive results appear to come only from the most visible reward strategies, such as bestowing monetary rewards that demonstrate the extent of management commitment or comparatively high level public or informal recognition (Ellis & Honig-Haftel. 1992)

2.6 Rewards System and Organisational Culture

Peters & Waterman (1982) talk about "Culture as the shared value of the company members". Kilman (1982) calls it the "collective will of members ..... indicating what the corporations really wants or what really counts in order to get ahead". Sethia and Von Glinow (1985) uses "Culture is the shared and relatively enduring pattern of basic values, beliefs and

assumptions in an organisation". Culture and reward system are highly intertwined. Stonich (1984) notes that current culture is a function of past policies. Lawler (1983) notes that reward system can reinforce and help define organisational structure. Reward system can help define the degree to which technical professionals can influence line management, and it can strongly influence the kind of decision making structure that exist. In short reward system can shape the structure because they influence motivation, satisfaction and membership. The behaviour they cause to occur become the dominant patterns of behaviour in the organisation and lead to perception and belief about what an organisation stand for , beliefs in and values (Lawler, 1983)

It has been found that particular types of organisational culture appear to function best with particular type of reward system. The matching combination fall into four distinguishable patterns (Von Glinow, 1985). These patterns are based on two important positions; the firms concern for people and their demand or expectation for employee performance. A company culture can be differentiated into four categories by taking high and low concern for people and performance. These four categories are apathetic culture, caring culture, exacting culture and integrative culture.

In an apathetic culture, there is little concern for firm's human assets and so is their concern over their performance. The caring culture show high concern for people as assets and has relatively low performance expectation. An exacting culture shows extremely high demand and expectation for performance with little or no concern for people. In integrative culture, there is high concern for people as well as high expectation for their performance.

All the different cultures supports a varieties of reward system. However, each culture is optimally compatible with only one specific types of reward system. These compatibility between culture and reward system are shown in Table-2.6A.

Not all high tech firms will fit neatly into one of the four categories. Further, a firm may encompass subcultures that resemble one of the four categories while the overall firm resemble a different category. Thus multiple reward system may co-exist in a given culture category. Given that multiple reward system may coexist in any given culture, it is useful to determine a priori which types of rewards are supported best by the existing culture. If cultural change is being envisaged then it may be useful to determine what kinds of reward and what levels of reward will best support the desired culture. Reward system change must be considered an integral part of the cultural change.

Table-2.6A

Compatibility of reward system for four cultures

Types of culture

Reward	Apathetic	Caring	Exacting	Integrative
Financial	Low	Average	Variable	Excellent
Status	Excellent	Excellent	Moderate	Low
Job Content	Poor	Average	Good	Excellent
Career	Poor	Good	Average	Excellent
Professional	Poor	Average	Good	Excellent

2.7 Dual Ladder System

Research on career preference of research professionals indicated two distinct types of career choices. Some prefer to grow in the organisational hierarchy by moving quickly into managerial jobs while others prefer to grow by doing technical jobs. These later category professional show strong desire to be evaluated by peers and professionals in their own discipline rather than by their organisation (Aryee & Leong, 1991). This preference for technical ladder is strong among professionals who are more qualified in particular when they have a Ph.D (Allen & Katz, 1992) . Thus creating room for conflict with the management. In an attempt to mitigate the professional and organisational conflict and to provide professionals with alternate career paths, some firms have implemented a dual ladder structure. It is a set of parallel position for professionals that is designed to be parallel to the managerial ladder, but with evaluation control, authority and advancement criteria appropriate for the technical professionals. The objective of using dual ladder are to provide advancement opportunities for professionals who are unable or unwilling to ascend the managerial ladder to provide compensation, recognition, and prestige equivalent to that of successful manager; to provide professionals with administrative duties light enough to not interfere with professionals contribution (Miller, 1986).

The success of the dual ladder has been mixed (Raelin, 1987). Miller notes that even the best dual-ladder program receive about equal number of complaints from non-managerial professionals as from managers. Most problems originate from the perception of unfair promotions. Succo & Knopka (1983) report that six criteria must be met for the dual ladder to be successful. The program must 1) have senior management support and commitment; 2) have credibility with

employees; 3) be flexible and adaptable to change; 4) defines the level of technical contribution at each rung in the ladder; 5) have a review process to assure quality and 6) have a high profile through publicity both inside and outside of the firm.

Riggs (1983) maintain that equity in pay alone is not sufficient to ensure its success. Dual ladder must involve recognition along with compensation. Lentz (1990) reports the success of a multi-ladder system in Dow Corning. It has two major points 1) Identification of four criteria that should be typical for all senior professionals, regardless of technical speciality and 2) A list of characteristics for each criterion. The promotion review committee consists of senior administrative and senior technical professionals.

It has also been reported that country culture and company practice also influence the career preference of the professionals. McCormick (195) noted that among the R & D professionals of Japanese company, there was strong preference to remain in front line R & D over a long period of the career while that among the R & D professionals in U.K. company's there was a strong desire to move into management as soon as possible.

Section 2.8 Pay System for R & D Professionals

Research on the pay system of R & D professionals indicate that both method and magnitude of financial rewards depend on a number of characteristics pertaining to the organisation (Balkin & Gomez-Mejia, 1984). It is observed that small size or new high tech organisations prefer an incentive based pay while mature and large high tech organisations prefer a standardised rate of pay. However, even though most large firms follow a standardised rate of pay, yet there have been studies showing the widespread use of internal evaluation of performance as a method to distribute income particularly for technical professionals (Zenger, 1992

Employment contract between managerial employee and the organisation have been a favourite topic of research among economists. One of the most difficult yet highly desirable aspect of managerial pay is the establishment of a direct linkage between pay and performance. Both theoretical and empirical research indicate that a performance contingent pay is the best way to ensure quality in performance (Khan & Sherer, 1990) However, such performance contingent pay system requires continuous and accurate monitoring of performance which can be quite costly in certain organisational settings. An accurate measurement of performance can be prohibitively costly where the jobs are non-repetitive and both the job content and context change rapidly with time or when the job is organised in the form of a team. Empirical analysis has shown that organisations

choose their method of payment between piece rate incentive based pay and time rate or salary based pay depending on the cost of monitoring of performance (Brown, 1990). Large firms because of their high monitoring cost generally prefer a time rate of pay while smaller firms prefer a piece rate or the performance based pay.

Among the different types of time rate system of pay, human capital based pay has been found to be quite popular among managers. According to human capital theory, individual earning and productivity grows in proportion to one's stock of human capital accumulated through conscious investment in time and other resources. If income is considered as the value of goods and services that one generates in the society then it can be said that variations of income among people are due to variation in the stock of human capital. Like investment in any other capital, an additional investment in this human capital brings in an additional income. Individual makes investment in their stock of human capital by considering this additional return from this investment and the cost of making this investment.

In addition to accumulating human capital by formal schooling, one also acquires human capital by the process of on the job training from the employing organisation. Assuming that only a fraction of working time goes into learning the job and organisation specific skills, and that this fraction decreases linearly with time, then as was shown by Mincer(1974) the Ln of annual earning could be expressed as a liner function of schooling in years and a quadratic function of work experience in the organisation or the market.

However, even though the human capital based pay provides a logical basis for internal pay structuring and a justification for general growth of individual earnings with experience, yet as a practical method for rewarding performance and enhancing motivation, it has not received a favourable response from the managers. In the absence of any internal evaluation, the policy of income distribution based on human capital can deprive the organisation from any control over attitude and behaviour of employees. Further , it may encourage " free rider" behaviour with it's long run behavioural and functional implications. In the absence of any direct measurement and recognition of this performance, the desired message of higher reward for better performance might not reach the employees. It is possibly this apprehension of free rider problem and the desire to have a better control over employee behaviour that made many organisations to go for mixed criteria of human capital and performance for the growth of individual earnings within organisation (Ministry of Finance, 1986). In this process of mixed criteria, one is assured of a fair return for their

accumulated human capital which indicates their general level of productivity. One is also rewarded for showing superior performance over and above others with similar stock of human capital. Malikel & Malkiel (1973) found about 71% of the variation of earning of research professionals within an organisation can be explained by the variation of educational qualification and work experience. It was also noted that the compensation for work experience acquired before joining an R & D setting was less when such experience was in an unrelated job. On the other hand Medoff & Abraham (1980) found that only 33% of the variation of relative earning of technical professionals within a single organisation could be explained by these variables. These highlights the general inapplicability of human capital model to explain the annual salary of professionals within organisations.

Performance in scientific task involve collection and processing of information from diverse sources. This collection and processing are facilitated considerably by academic training in institution of higher learning. Further, knowledge creation in general and technological knowledge in particular are cumulative and interactive process. In knowledge accumulation and acquisition there is an advantage of cumulative acquisition for those who already possess a sizeable amount of knowledge (Allison & Stewaret, 1974). Thus even though the basic skills required for a satisfactory performance are same in all job levels within an R & D unit yet the efficiency and quality of performance are expected to differ by the cumulative knowledge as evidenced by the academic qualifications. We can assume that a part of the performance evaluation are actually transferred to academic institutions. Thus a performance evaluation system is likely to show higher performance for more educated professionals. This in turn should show higher income for more educated personnel.

Due to creative nature of their jobs and due to their long association with academic environment, the R & D professionals identify more and more with professionals and peers in other organisations. They seek recognition and appreciation of their work more from peers and professionals working in other organisations (Connor, 1984) This desire for social recognition makes their performance quite visible and known from outside. While designing a pay and reward system, it is important to look into these channel of recognition and to what extent these route is blocked due to strategy of the organisation.

Compensation has been a major source of frustration and cause of employee turnover (Weiner, 1980). The R & D professionals work in an environment with accurate shortage of

manpower. The turnover of these professionals is further facilitated by easy visibility of their performance. Study on attitude and disposition of R & D professionals also suggested that pay expectation of these professionals are highly affected by the opportunities available in the market (Das, 1995). A pay that is not competitive with similar other organisations may not succeed in maintaining the pay satisfaction at high level. Since retaining the high performers is critical to success of R & D project and replacement of these key personnel is quite costly and time consuming, it is expected that high tech organisation would maintain a competitive pay if not above the rates of similar other organisations (Bretz et al, 1992).

Research on the pay distribution among R & D professionals in public sector system have indicated that though pay structure was highly competitive internally, but was quite insulated from the market (Das, 1996). Such market insulated pay system is likely to lead to high level of pay dissatisfaction among the R & D professional which may affect their motivation and in its extreme form may lead to high turnover. Study on the pay satisfaction of R & D professionals indicated that internal comparison plays a very minor role in affecting the pay satisfaction. But the external pay and career comparison is a very important source of satisfaction (Das, 1997).

Section 2.9 Performance Appraisal System

One of the difficulties in developing an effective appraisal system is that R & D tasks have certain unique characteristics e.g. non-repeatability, complexity and novelty (Domsch, Gerpot & Jochum, 1986) It has been shown that success of an appraisal system in R & D is especially based on the confidence in the utility of the system.

Research on the effectiveness and rating of R & D engineers were found to be affected by the difference in organisational level and organisational task (Ivancevich, 1983) . It was also observed that even a very well designed appraisal system may fail when the trust on the ability of the subordinate is low due to complexity of the job.

There have been good number of studies on the gaps between appraisal research and appraisal practice in organisations (Bretz, Milkovitch & Read, 1992). Some writers feels performance research has done little in improving the managerial decision-making (Baker & Murphy, 1985). Some have suggested the issues dominating the appraisal research are at odds with organisational realities. Benardin & Vilanova (1986) suggested that better understanding of the organisational contexts in which appraisal takes place was necessary in order to improve its acceptability.

Much of the recent research in performance appraisal system has been dominated by the information processing issues. It concentrated around two issues 1) how prior expectation or knowledge of prior performance affect the way new information is processed. And 2) role of memory in rating process. Ratter's knowledge of prior performance appear to affect information processing by framing or anchoring current judgements. Laboratory research indicated that knowledge of prior performance caused contrast effects rather than assimilation effects (Murphy, Balzer, Lockhart & Eisenman, 1985; Smitter, Reilly & Buda, 1988)

The role of memory has also been important in recent cognitive process research. Memory decay introduces a bias into the rating process. Kozlowski & Kirsch (1987) suggested that memory decay affected the ability to recall job and information and resulted in halo error and subsequently inaccurate ratings. When the ratters memory demands are great bias in favour of general impression or recent performance are expected (Murphy, Gannett, Herr & Chen, 1986).

Research on the usefulness of self-appraisal indicated that it is best suited for developmental purpose rather than evaluative purpose.

Appraisal feedback: Discussion of pay and advancement during performance feedback session was shown to lead to higher employee satisfaction with the process but did not influence future performance (Dorfman, Stephan & Loveland, 1986). It was reported that feedback describing as 'satisfactory' as compared to average or outstanding led to reduced organisational commitment and negative attitude towards appraisal system.

Becker & Klimoski (1989) reported that feedback from supervisor led to increased performance but feedback from peers did not. Ilgen & Moore (1987) explored feedback content in a laboratory setting and found that feedback about quantity led to higher quantity, feedback about quality led to higher quality and feedback on both led to higher performance on both.

Performance Appraisal Format: Management by objective is the most preferred format for assessing executive, managers and professional's employee. Other format e.g. trait based rating are far less common. However, mixed format are most common. This reflect the multiple purpose for which the appraisal is done (Bretz et al. 1992)

Ratter & Source of Rating Information: The vast majority of performance rating is done by the immediate managers. For managerial and professionals employee the second level managers also provide some significant input.

Performance Distribution: Performance appraisal system typically have five levels to differentiate the employee performance. However, only three levels are in use in most organisations. Both desired and actual distribution tend to be top heavy. It is not uncommon to have 60 to 70% of workforce rated to be top performers (Bretz et al. 1992)

Perceived Fairness: Using a managerial sample Greenberg (1986) reported that perceived fairness of performance evaluation depended on the presence of procedural characteristics (e.g. communication, appeal process, job knowledge and consistency (e.g. rating based on performance, action based on rating. It has been found that the perception of an appraisal system was affected by the organisationally conferred status and education level of the R & D professionals (Das, 1998). Higher is the level of qualification, higher is the individual sensitivity towards performance appraisal system.

Section 2.10 Inter-Organisational Mobility and Career

One of the important characteristics by which the R & D professionals differ from professionals working in other functions of the organisation is that they have low identification with the organisation and high identification with the profession. In contrast to `local' career orientation of other engineers, R & D engineers maintain some degree of `cosmopolitan' outlook in their career goal. This career orientation is manifested in form of desire for inter-organisational mobility and career equity with similar other organisations (Das, 1997; Goldberg, 1981). This mobility is further encouraged by the perennial shortage of quality manpower and the practice of covert as well as overt piracy by high tech organisations (Reynolds, 1982).

There have been studies looking into the change in income of scientists and engineers after a voluntary turnover (Cooke, 1980). There have been a few studies looking into career progression of these professionals following a change in their work organisations. This has been necessary due to the positive benefit that has been found to accrue to both the sending organisation as well as receiving organisation following such exchange of scientists.

Research on the relationship between scientist's mobility and the effectiveness of a research system indicates a curvilinear relationship between the two with an optimum mobility that varies from organisation to organisation. (Goldberg 1981) The research effectiveness rises with increasing mobility due to better information transfer between organisations. The effectiveness reduces after certain level of mobility because the negative effects of employment instability overtake the positive impact of greater information and technology transfer (Brickman, 1977).

The mobility of scientists has been found to be most effective when formal mode of information source and opportunity to acquire it are weak. Technologists and scientists working in industrial environment generally do not get much access to formal sources and opportunity to publicise their findings through the printed media. Their principal mode of acquiring and assimilating information and knowledge is through informal communication with colleagues and peers working in other organisation (Allen, 1977; Davis & Wilkof, 1988). A newly recruited-experienced technologists may bring with him a considerable amount of expertise both on the technical and methodological aspects as well as the commercial aspect of a new research and technology issues. Information about success or failure of many scientific pursuits are seldom published in a document form. By allowing the scientists and technologists to meet their colleagues and partners working in other organisation and by recruiting experienced people from such other organisation, the receiving organisation can get access to this unpublished but valued information. Sometimes entry of such experienced professionals from outside bring in a new perspective to the research goal and the methodology of attaining it (Zuckerman & Merton, 1972).

Mobility can also raise the visibility of the young scientists whose image are overshadowed by the presence of a highly reputed senior in their present organisation. A change of organisation can provide the much needed attention and recognition to young researchers (University of Chicago, 1971).

Movement of research professionals also helps in building a national research system by reallocating human resource in keeping with the changing economic and technical environments . It provides the needed flexibility to match the individual interest and capabilities and the available work positions (Johnson. In a dynamic technological environment, organisational priories and research goals can change quite rapidly. This change can bring in considerable surplus and shortage of essential skills. It is only when reallocation of researchers is allowed and encouraged that we can utilise the full potential of the technical resource effectively.

At the individual level, a change of job is always preceded by a search for a job that suits individual aptitude, skill and career goals. This search and experimentation are risky and quite costly (Das, 1989; 1990). Nevertheless, it is an activity that is necessary to attain a better match between job, people and organisational opportunities (Johnson, 1978). It was also observed that rate of return to educational investment above a basic degree in engineering was higher when R & D professionals had prior work experience (Das & Akhilesh, 1994).

Chapter-3: Scope and Methodology

3.1. Scope of the Study

The scope of the present study will attempt to cover broadly the following questions:

(1) What are the different forms of rewards that exists in the organisation and how often these rewards were used in the organisation during the last 5 years?

(2) What criteria are used to establish the average pay and range width of pay in different grades? Is there any relation between this average pay and the level of responsibility of the scientists?

(3) What are minimum, maximum and most probable times for promotion to higher grades?

(4) Is there any fast track for superior performance? What percentage of total manpower are in fast track, what percentage are in career plateau and what percentage are in dead end job?

(5) What are the effects of mixed criteria based promotion policies on the annual earning of the individual?

(6) What are the incentives for higher educational qualification, work experience and performance?

(7) What are the rates of return to educational investment, work experience and performance?

(8) What are the effects of higher educational qualification, work experience and performance on the probability of promotion?

(9) How competitive is the career of R & D professionals across similar other organisations?

(10) What criteria are used to decide the starting grade and salary of professionals joining with considerable work experience in other organisation?

(11) What is the pattern of turnover phenomenon in different grades?

(12) How does some of the results compare with findings of studies done in other countries?

3.2. Methodology

3.2.1. Definition of Scientists

Literature on professionals, makes a distinction between scientists and engineers. It is generally assumed that scientists work more on topics that are of wider significance to mankind and society at large while engineers and technologists work more in the area of applied science or engineering whose benefits are principally accrued to specific organisation that employ them or sponsored such researches. In Government establishments, we have scientists with training in basic science as well as in engineering working almost on the same types of problems. As such we do not make any distinction between scientists with a Masters degree in science or Mathematics and engineers with a basic degree in any of the engineering disciplines. We shall assume that all who at the time of the survey had at least a Bachelors degree in engineering or a Masters in Science or equivalent are scientists. Unless otherwise specified, a Masters would mean a Masters in Engineering. As such we have used the definition adopted by the 5th Central Pay

Commission (Ministry of Finance, 1997). The present study covered the career and reward of all scientists and engineers in the organisation who satisfy the above criteria.

3.2.2. Definition of Rewards

In organised sector employment, a good performance is recognised by a varieties of rewards e.g. faster promotion in the hierarchy, good pay growth in the form of more increments in a year, advance increment at the time of joining, annual performance based bonus, cash incentive, opportunity for training and various form of certificates and merit rewards. The present study considered monthly basic salary, growth of basic salary with age, promotion, and other non-promotion and non-monetary awards as part of the organisational reward system for superior performance.

3.2.3. Definition of Fast Track and Stagnation

In hierarchical organisations, one of the most often used recognition tool is promotion in the hierarchy. When such promotion are based on annual performance this tend to create a situation where employee with higher capabilities and higher performance get their promotion at a faster rate than others. Because the quality of good performance sustain over a period of time, it is quite likely that good performers would get all their promotions at a faster rate than others. Thus over time, these people would be on a fast track career where al their promotions would be at the shortest possible time available from the organisation. We have used the definition of Baker, Gibbs & Holmstrom (1994) whereby two successive promotions at the shortest possible time are considered as fast track career. This definition is slightly different from the 'Fast Track" career used by Pay Commission. According to them, the fast track is a group of non-overlapping pay scales with higher than normal annual increments to cover the pay range (Ministry of Finance, 1986). Department of Atomic Energy used three non-overlapping pay scales in the first three grades of the scientists in their organisations before the Fourth Central Pay Commission. But this was abandoned later.

Along with fast track, we have used stagnation as a blocked career. We have considered stagnation as missing two normal promotions in a row. Here also we have deviated from the definition of stagnation used by the Fifth Central Pay Commission (Ministry of Finance, 1997). According to Pay Commission, stagnation are situation when a person has already reached the highest pay of a pay grade and there was no scope for pay

growth without promotion to next higher grade.

3.2.4. Definition of Lateral Entry and Fresh Recruits

Most professional organisations in general and R & D organisations in particular, follow a policy of recruiting specially experienced people from outside. This is done because this way it can avoid the huge investment required to develop all its manpower requirements from in-house training. This mid-career people also bring along a different perspective to the organisation. In the present study, we have assumed that whoever joined with more than 30 years of age at the time of joining was a lateral entry recruits. Similarly it was assumed that when the age of entry was 25 years or less it was a fresh college recruit. We compared the career of lateral entry recruits with those who joined fresh from college.

3.2.5. Definition of Competitiveness in career

Pay and grade are the two most important job outcome in the organised sector employment. Employees in general and R & D professionals in particular are very much affected by a comparison of their career across similar other organisations (Das & Bhadury, 1997). In this comparison individual tend to pick up a reference about which they can collect information easily and which they consider relevant. Thus career of referent person who are at the same age as self is a source of important comparison. In this study, the average salary and grade at different age groups in different organisations are used to understand the level of competitiveness across organisations.

3.2.6. Choice of Department and Organisations

Since our objectives was to understand the career of scientists engaged in Govt. Laboratories, obviously our choice was restricted to Govt. labs. Because all Govt. labs follow almost same recruitment and pay policies, there was no particular reason to choose one or the other Department except their desire to participate in the study and their ability and willingness to share relevant personnel records in a convenient form. Considering the duration of the project, we choose four departments of the Govt. who were major employers of scientists and engineers in their R & D set ups and whose personnel records were in a readily available form. These four Departments collectively spend more than 70% of the R & D budget of the central Government. Naturally the human resource policies and its practice in these departments will have far reaching impact on the supply and demand for R & D manpower in the country.

We chose one lab from each of these four Department of the Government. Henceforth these labs will be identified as Lab-A, Lab-B, Lab-C and Lab-D. The director of these labs were contacted describing the objective of the study and the type of data that would be needed. A copy of this letter is shown in Appendix-A. They were also assured of complete anonymity in all reports and papers written out of their data. It was also assured that they will be given a summary of findings from their own organisation before a final report is prepared. All but one labs. were given a copy of the results from their labs and their comments and observations were incorporated in the final report. In view of the need for maintaining anonymity about the source of data we shall not be discussing any of the labs in any detail.

3.2.7. Method of Data Collection and Types of Data

The study required data on all scientists working in the selected labs during the year 1997. The type of data needed were data on name or employee code, present designation, the year of joining the current post, date of birth, year of joining the organisation, educational qualifications after 12 the standard, the year the bachelors in engineering or Masters of Science was acquired, area of specialisation, present basic salary (Pre-revised), work experience one had at joining time, monthly basic and gross salary at joining time, the year past promotions were received, performance appraisal scores for each year since joining, any reward other than promotion received since joining, project responsibility in terms of project cost, project duration, and number of people working, any off company training received in last three years. In addition data on those who resigned from the organisation in last five years was also collected on the following items: Name or employee code, date of joining and date of leaving, date of birth, grade at which joined and grade from which resigned, basic salary at joining time and leaving time, dates at which past promotion were received, academic qualifications at joining time and leaving time, performance appraisal scores for each year from the year of joining. In order to analyse the above data we needed information on organisational policy of recruitment, promotion and performance appraisal and policies on other non-promotion types rewards if any.

Out of the four labs two labs. Viz. Lab-A and Lab-B readily agreed to participate in the study. Lab-C took a while to agree to participate. Lab-D agreed to the study but did not have readily available data in their office file containing all the personnel records.

However, they were preparing a Human Resource Information System for all their scientists in India and they just collected some voluminous data by a questionnaire from their scientists in the Lab-D. They agreed to share this information with us. Though this data file did not have all the data needed for the study, we agreed to make use of this data and supplement it from other sources. One of the problem with this data set was that because it was collected by a questionnaire from the individual scientists, this data had a lot of missing and inaccurate information. During analysis this was detected and the organisation was contacted for correction. A supplementary record with corrected salary data was received in January 1999 !

3.2.8 Characteristics of Actual Data Received

Office record file of Lab-A was available in a computerised form and they gave this data file in computerised and hard copy form after removing the names of the scientists. This data file had records of 320 scientists. It had date of birth, date of join, date of last promotion, current grade, educational qualifications, current basic salary and staff no. The basic characteristics of current manpower are shown in Appendix-C. A similar data was also given for those who resigned from the organisation last five years. Regarding performance appraisal records and promotion records, they gave data for 50% of the scientists for the last 10 years. Data file did not have work experience prior to joining, education qualification at the time of joining and grade and salary joined. In order to collect this data, a separate questionnaire was run on a sample of 150 scientists. 110 filled questionnaires were received. This is shown in Appendix-B.

Personnel record of Lab-B was not fully computerised or were not in a form that could be shared for project purpose. However, they agreed to give hard copy of each person within a couple of months time. They engaged a few of their personnel to prepare this hard copy and gave us in a couple of months. They provided data records of 203 scientists from the organisation which was about 95% of the total number of scientists working in the organisation at the time. The basic characteristics of this data are shown in Appendix-C. This data sheet however did not have record on work experience, salary and grade at joining time. They also gave data sheets for those who left the organisation in last five years. They however, expressed their inability to share the performance appraisal records of any scientist. A questionnaire survey was again conducted to collect some of the missing

data in the office record. A sample of 160 filled questionnaire were received. This questionnaire is shown in Appendix-B

Lab-C had a well-designed human resource information system. They prepared a separate file for the required data save for the performance appraisal data and gave us both the computerised as well as the hard copy. Their data file had staff no, current gross and basic salary, date of birth, date of joining, when last promotions were received, grade at which joined, work experience at joining time, name of the organisation they worked before, educational qualifications and the years they were completed. Along with this they provided a similar file for those who resigned and retired in last five years. They also expressed their inability to share the performance appraisal records. A total of 1017 data records were there in the data file. I was told this file had record of all scientists working. For the purpose of analysis 50% systematic sample was chosen. Some data records had to be deleted due to incomplete information. Basic characteristics of this data are shown in Appendix-A. A separate file containing record of those who left the organisation in last five years was also collected.

Date file of Lab-D had data on staff no, date of birth, date of join, educational qualification, the year the educational qualifications were acquired, date of last promotion, current grade, basic salary on a fixed date, prior work experience and promotion records since joining for all scientists. It had many other related information but they were not relevant to our study as such they were discarded. This data file had records of 618 scientists which was the actual number of scientists working at the time. Due to inconsistency and missing data many data records could not be used from this file. They were willing to provide data on those who resigned from the organisation in last five years. However, this data was taken because only five people left the organisation voluntarily in last five years.

In addition to personnel record of scientists working at the time, all the organisation provided documents describing policies on recruitment, grade, promotion and performance appraisal and recognition and documents on non-promotion types rewards and awards recipients and policies.

3.2.9 Other Sources of Data Used

In addition to primary and secondary data on currently working scientists and information on organisation policies, we also made use of past Central Pay Commission Records and internet and member directory of the International Association for the Management of Technology (IAMOT), USA. Pay Commission records were used to understand the rationale behind the existing pay grades and career development policies for the scientists. Internet and IAMOT member directory was used to collect information about performance recognition policies for research workers in other countries. However, because of the strong strategic importance, we could not collect very much information from other countries.

3.2.10 Methods of Analysis

Data was analysed by the method of percentage distribution, methods of average comparison and the methods of average estimation by the least square method. Details of others methods are explained in the appropriate result sections.

Chapter 4: Results

Section: 4.1: Pay Scales and Recruitment Policies

i. Pay Scales: Tables-4.1A and Fig-4.1 A showed the pay scales for scientists as was given by the 4th Pay Commission and implemented by these laboratories. Like all other Departments of the Government, the R & D services of the Government was also organised in a hierarchically structure. The number of levels and the actual range of pay for different grades were identical in Lab-A and Lab-B. Lab-C had one additional level at the entry point and two additional levels at the top side. This is shown in Table 4.1 A. The number of levels and their range of pay in Lab-D were slightly different from other labs. In this lab, there were fewer levels and the range width was slightly higher for the middle level.

From Table 4.1A, it could be seen that the jump in average pay of scales started with a high of 21% and went down to 4.8% in the highest level. This was fully in keeping with the fact that learning new sills were faster and needed higher incentive in the beginning of career than towards the end of career.

It was to be noted further that overlap between adjacent pay scales were very high. The overlap was as much as 54% between the two scales. This overlap in pay scales indicated that though there was difference in the type of jobs done in two levels but there were some common types of activities between two adjacent levels. The high overlap between adjacent levels indicated that, in terms of activities there was possibly not much of a difference between adjacent levels. It was also one of the reasons why even a very fast promotion might not lead to a substantial gain in salary.

Table-4.1B showed the starting grades of fresh Ph.D., Masters, and Bachelors degree holders in Engineering. The stating pay of fresh engineers was same in Lab-A, Lab-B and in Lab-D. In Lab-C, they started career at a lower scale. It was to be noted that starting grade for fresh engineers in these Govt. labs. were Rs2200 while that in R & D units of Public Sector Undertakings it was Rs2500/- (Das, 1995)

Thus to begin with the Government Labs. suffer from an inequity in pay system. This inequity at the entry level may have serious implication in their ability to attract good many engineers from the market.

ii. Starting Grades of More Qualified Personnel.

Table-4.1B showed the starting grade of professionals with qualification more than the basic requirement viz. Masters in Science or Bachelors in Engineering. It can be seen in all the four Labs. Masters in Engineering or M.Phil. in science without any work experience starts at Grade-1 with starting salary of Rs2200 with no additional increment whatsoever. This indicates that from the organisational point of view, there is no difference between a Bachelors and a Masters in Engineering. This is in contrast to R & D units in some PSU where a Masters in Engineering gets two additional increments at the time of joining (Das, 1995).

It was to be noted that starting salary of fresh Ph.D. degree holders without any work experience were Rs2200 in both Lab-B and Lab-D while in Lab-A and Lab-C it was Rs3000/-. This further highlighted the point that in some labs, higher academic qualification was highly undervalued. This low financial incentive and high inter-organisational difference in policies towards higher academic qualification meant that some of these organisations would have difficulties in attracting very many highly qualified engineers unless the job risk characteristics of these organisations were very different and considerably less than others.

iii. Treatment of Work Experience for Lateral Entry Recruits.

No organisation can hope to develop all its manpower requirements entirely from its own in-house training and experience. This is more so in research and development organisations where technological change and its impacts are more dramatic and more acute than in any other commercial organisations. Because of the fast changing technological environment, these organisations may find themselves continuously unprepared to cope with the changing knowledge and skill requirement of the job. Skill obsolescence is one of the perennial problems in high tech organisations. In order to maintain its competitive edge, they need to hire manpower at different levels continuously on a regular basis.

In order to attract this specifically qualified and experienced professionals, all organisations follow certain policies which prescribes rules for treating this outside experience.

Table-4.1C showed these policies for lateral entry in these organisations. It was to be noted that both Lab-A, Lab-B and Lab-C have specific policies to recruit experienced professionals in Grade-2 but that in Lab-D there was no such policy for recruiting experienced people. Further, in Lab-A, Lab-B and Lab-C, a Bachelors in Engineering or a Masters in Science could join in Grade-2 if they had 4 years of experience in R & D in some other organisation. In Lab-A and Lab-C professionals with a Masters in Engineering could join in Grade-2 after two years of experience elsewhere. Thus these organisations effectively compensated for one's investment in acquiring a Masters in Engineering. But in Lab-B, the years of work experience required to join Grade-2 was same irrespective of qualification.

If one had a Ph.D. in Science, one needed one years of experience to join in Grade-2 of Lab-A but could join directly in Grade-2 of Lab-C. But in Lab-B, there was practically no relaxation of experience requirement for such higher qualified professionals.

The treatment of Ph.D. in science and Ph.D. in Engineering in Lab-A indicated that Ph.D. in Engineering was more preferred over that in science. A Ph.D. in science needed at least one more year of experience to join Grade-2. This indicated that these organisation took into account the fact that in science one can go for Ph.D. directly after completing a Masters in Science while that in Engineering sometime one has to do a Masters in Engineering before registering for Ph.D. This effectively adds one extra year of investment for a Ph.D. in Engineering than that of a Ph.D. in Science.

Direct entry in Grade-3 was also possible in all the labs. Masters in Science or Bachelors in Engineering needed 7 years in Lab-A, 8 years in Lab-B. In Lab-D it was not possible to join in Grade-3 without an M.Phil. or a Ph.D. degree. An M.Phil. needed 8 years to join directly in Grade-3 and a Ph.D. needed 5 years of experience to join directly in this Grade. In Lab-C there was no specific policy for direct recruitment in any grade above Grade-2.

It was to be noted that in both Lab-A and Lab-D, the job of scientists were more individual project oriented while that in Lab-B and Lab-C were more mission oriented project with involvement of many people over quite a long time.

The absence of any policy for recruitment above Grade-2 in Lab-C indicated that they did not encourage very many lateral entry from the market. It was quite possible that they felt there was no other similar organisation in the market where one could gain similar work experience. This policy also ensured a better career for internally available talents.

The lateral entry policy of Lab-B, indicated that higher grades were equally open to market and work experience went for a premium over higher education.

The lateral entry policy of Lab-A, indicated the treatment of outside work experience was at par with internal work experience with highest level of performance in the annual appraisal exercise. Higher qualification was highly valued and it reduced the minimum service requirements proportionally.

iv. Treatment of Higher Qualification in Recruitment Process

Table-4.2C showed the financial incentive available for acquiring higher academic qualifications. This is also shown in Fig- 4.2C. Assuming that when one acquires higher qualification and compete through open channel and gets to the next higher grade at the first attempt while others without this qualification continues in the same grade, we can calculate the financial incentive at the time of promotion by taking the salary of others who did not go for higher education. Assuming that a Masters in Engineering takes two years to complete, a Ph.D. in science takes four years to complete and a Ph.D. in Engineering takes five years to complete, we find in Lab-A the financial incentive for acquiring a Masters degree is 20%, a Ph.D. in Science or Engineering is 16.5%. This has been calculated by including the normal annual increment during the time of acquiring the degree and the work experience required to attain eligibility for higher grade.

In Lab-B, the incentive for Masters in Engineering is 13.2%, for Ph.D. in Science is 7.1% and for Ph.D. in Engineering is 4.3%.

In Lab-C, the incentives for a Masters in Engineering and a Ph.D. in Science are 20% each and that for a Ph.D. in Engineering is 13.2%. In Lab-D, incentive for M.Phil. and Ph.D. is 23.3% each.

Thus we find the incentives for higher academic qualifications are better in Lab-A and Lab-D than that in Lab-B or Lab-C.

In summary, we find the existence of a non-competitive starting pay in these labs. The treatment of higher qualification and work experience are quite different in different labs. The financial incentive for higher academic qualification above the basic degree varies from a low of 13.2% to a high of 23.3%. In some labs the recruitment policies for higher grades do not compensate well for ones investment in higher education.

Table 4.1A

Pay Scales:

Grades	Old Scale Rs	% Growth over the mid Point and Percentage overlap	Lab-A Rs	Lab-B Rs	Lab-C Rs	Lab-D Rs
0	2000-3500		No	No	Same Only for a year	No
1	2200-75-4000		Same	Same	Same	Same
2	3000-125-4500	21.0% (53.5%)	Same	Same	Same	3000-5000
3	3700-125-5000	8.75% (38.5%)	Same	Same	Same	3700-5700
4	4500-150-5700	17.24% (50%)	Same	Same	Same	4500-7300
5	5100-150-6300	11.8% (33.3%)	Same	Same	Same	No
6	5900-200-6700	10.5% (57.1%)	Same	Same	Same	No
7	5900-200-7300	4.8%	Same	Same	Same	Same
8					7300-7600	7300
9					8000	

( ) Percentage overlap in scale

Table- 4.1B

Starting Grades for Fresh Engineers:

Education	Lab-A	Lab-B	Lab-C	Lab-D
M.Sc, BE	2200	2200	2000	2200
M.E.	2200	2200	2200	2200
Ph.D.	3000	2200	3000	2200

Table-4.1C

Policy for Lateral Entry

Grade	Lab-A	Lab-B	Lab-C	Lab-D
2	MSc+ 4 Yrs ME + 2 Ph.D.(Sc) +1 Ph.D. (Eng) + 0 yrs	MSc+4 Yrs ME + 4 Ph.D. + 4 yrs	BE + 4 yrs ME + 2 Ph.D. + 0 Yrs	No direct recruitment in this grade
3	MSc + 7 Yrs ME + 5 Yrs Ph.D. (Sc) + 4 Yrs Ph.D. (Eng) + 3 Yrs	M.Sc + 8 Yrs ME + 8 Yrs Ph.D. + 8 yrs	No Specific policy	M.Phil. + 8 years Ph.D. + 5 Years
4	M.Sc + 10 Yrs ME + 8 Yrs Ph.D.(Sc) + 7 Yrs Ph.D. (Eng) + 6 Yrs	MSc + 10 yrs ME + 10 Yrs Ph.D. + 10 Yrs	No specific policy	Ph.D. + 10 Years

Table-4.1D

Recruitment Policy and Financial Incentive for Acquiring Higher Qualifications

Incentive for	Lab-A	Lab-B	Lab-C	Lab-D
ME/ M.Phil.	20%	13.2%	20%	23.3%
Ph.D. (Sc)	16.5%	7.1%	20%	23.3%
Ph.D. (Eng)	16.5%	4.3%	13.2%	23.3%

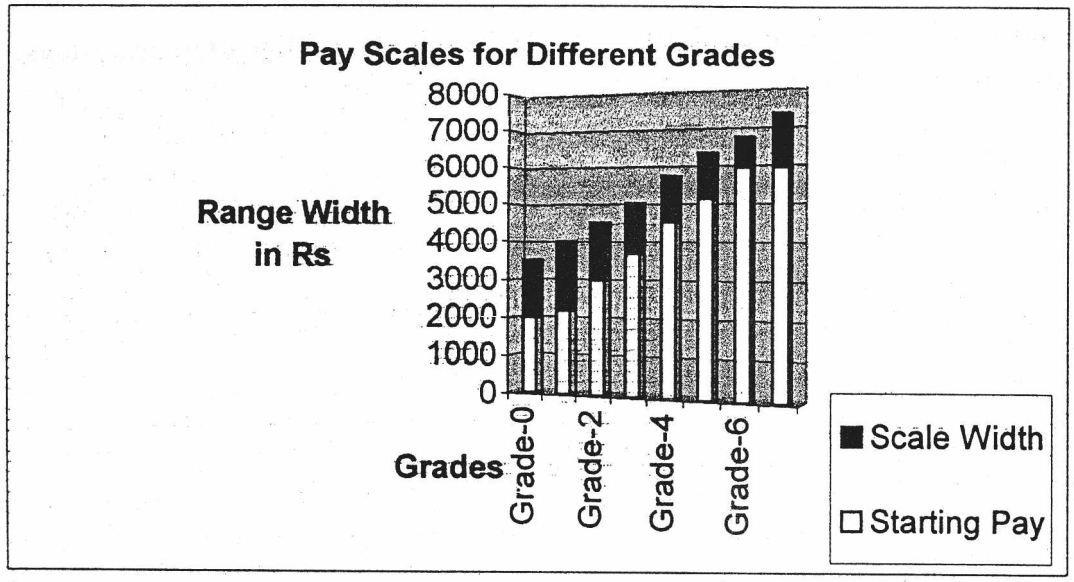


Fig-4.1A

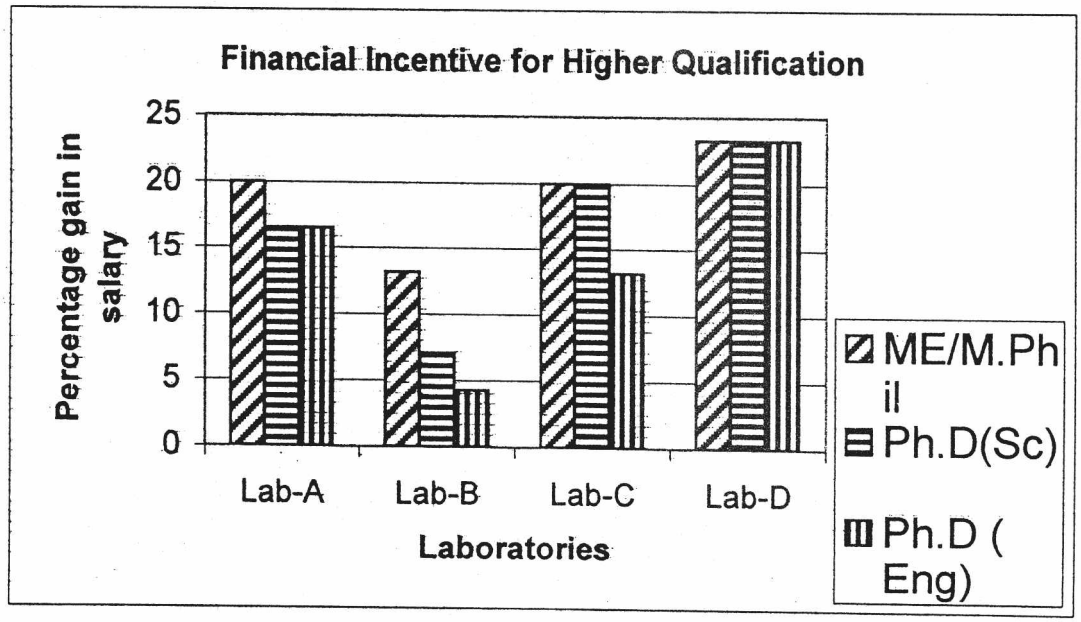


Fig-4.1D

Section 4.2: Performance Appraisal System

Performance appraisal system is a very important tool to identify good performers and to understand specific skill deficiency of individuals so that corrective action can be initiated. By identifying superior performers it helps in making the organisational reward distribution more fair and just and by identifying specific deficiencies of people, it helps them to improve their skill and capabilities. However, as we have commented in Chapter-2, because of the unique nature of the job done by R & D professionals, it may be quite difficult to find an appropriate method to evaluate performance of all scientists irrespective of the type of job that they are doing and the process that they follow. Nevertheless, it is still used by most organisation and some do a better job than others.

We have analysed the quality of the appraisal system on the following 9 items.

i. Input used for assessment
ii. Assessment Goal:: Performance, Behaviour or Target achievement
iii. Weightage between performance and behaviour
iv. Person who does the assessment
v. Method of measurement: Scale used
vi. In built mechanism to ensure consistency
vii. Frequency of measurement
viii. Feedback process
ix. Reward contingency

The policies of the four labs with respect to the performance appraisal of their scientists and engineers are shown in Table 4.2.

Input for Assessment: As can be seen from this table, all the four labs. take personal data and personal statement of work completed as an important input in the assessment. Thus the system has an appropriate mechanism to ensure participation of the appraisee in the appraisal process.

Assessment Goal: Performance assessment can be done based on attainment of specific goal, on performance of different tasks or from the observation of appropriate behaviour required to achieve organisational objectives. In situations where target setting are difficult due to too many unknown and unpredictable variables, performance method is

emphasised where the completion of specific job both on its quality and quantity are assessed. In addition when tasks are long duration types and assessment of quantity or quality of performance is difficult, behaviour observation technique is more desirable.

Row-2 of the table shows that all the four labs use measurement of both performance and behaviour in their appraisal exercise. In addition Lab-D specifically instructs the reporting officer to set specific goal for the scientists reporting to them.

Weightage between performance and behaviour: The importance given to performance and behaviour vary according to the average time required to complete a job. When the job is very long run oriented and or the process of completing the job is very unique, it is not possible to measure performance. Naturally in those situations the behaviour assessment are more emphasised. Row-3 shows that in Lab-A 75% of the final appraisal score depends on the measurement of performance while the rest comes from behaviour. In Lab-B, 60% of the final scores comes from measurement of performance while the rest 40% are assessed from behaviour. The weigtage for performance and behaviour are same in all the grades in Lab-A while in Lab-B it changes as we move up in the hierarchy. In higher grade the percentage of behavioural component in the final assessment is higher than that in the lower grades.

In Lab-C though performance and behaviour are assessed but how they are combined in arriving at the final score is not explicitly stated in the appraisal form. It is left entirely to the discretion of the evaluator. The picture is same in Lab-D. It is possible that management of these labs believe that the task performed and the process followed by each scientists in these labs are unique in some way. It is not desirable to set any rule which is universally applicable to all scientists. It is better to leave it to the discretion of the assessor because he is direct contact with the person and more familiar with the job than anybody else.

Assessor: Acceptability of a performance measurement and its importance to the appraisee depend to a considerable extent on the credibility and trustworthiness of the evaluator to the appraisee. The person who does the evaluation is as much important as the criteria followed. Row-4 shows that in all the organisations, the reporting officer does the actual appraisal irrespective of the type of job done. It indicates the issue of credibility of the appraiser to the appraisee is not taken very seriously in these

organisations. It assumes the reporting officer who is generally the hierarchically superior, has full knowledge of the job, is well aware of the context in which it is done and have enough opportunity to observe the actions of all the scientists reporting to him.

Method of Measurement: What method to use to measure actual performance. There are varieties of method e.g. essay appraisal techniques, graphic rating scale, Behaviourally Anchored Rating Scale, Critical Incident Method etc. All these different methods have advantage and disadvantage in different job settings.

From Row-5 of the table it can be seen that Lab-A and Lab-B use a Graphic Rating scale to appraise performance and a numerical scale for behaviour which are then combined on a fixed ratio to arrive at a total score in percentage form. In addition they have provision to note special critical positive as well as negative characteristics and achievement of the individual. Because it uses a graphic rating scale without any guideline as to what would constitute a high or low performance, the method may suffer from the error of central tendency.

Lab-C follows quite a different method. It measures performance in a descriptive way: a kind of essay appraisal technique. It measures behaviour by a method which is quite close to a Behaviourally Anchored Rating Scale technique. This scale gives a short explanation as to what behaviour is most acceptable and what behaviour are least acceptable. Thus it tries to rectify some of the most common problems of graphic rating scale. The final score is arrived at by combining the essay appraisal of performance and behaviour assessment and is given on a 8-point scale. The way to combine it is left entirely to the judgement of the appraiser. Like in other labs, in this lab also, there is a provision for noting special characteristics and behaviour.

Lab-D follows the essay method to note both performance and behaviour. The final score is based on both performance and behaviour and is given on a 5-point scale. There is also the provision of noting special characteristics and behaviour.

Verification of Consistency: Because the performance measurement depends very much on the judgement and observation of the reporting officer, it is prone to some common error like leniency, halloo and similarity etc. One way to reduce such possibilities is to increase the number of appraisers and get an average rating over all the appraiser's rating. However, it is not always possible to get enough number of people

with knowledge of the job and the opportunity to observe a person doing the job over a certain period. This limits the number of person who can and would be willing to do the job of appraising others.

Row-6 of the table shows that in all the labs, the final score is checked at two or three higher levels above the reporting officer. Because the higher level officers are familiar with the job of a junior officer, this gives a kind of monitoring mechanism to control systematic error and bias in the measurement and evaluation.

Frequency of Appraisal: There is no hard and fast rule about the frequency with which performance appraisal should be done. The frequency of doing appraisal should take into account the average time to complete a job and the average time it takes to show some significant performance by any individual. In R & D setting many jobs are long term oriented as a result doing a very frequent appraisal may be problematic. It is also the reason why we cannot find an optimum frequency which will suit all scientists. At the same time a very infrequent appraisal may create the problem of not being able to recall what and how a job was done. Row-7 shows that all the organisations follow a standard practice of doing the appraisal once a year.

Feedback Mechanism: Feedback is a process to communicate both good and bad performance and behaviour to the employee so that they can correct their mistakes in future. Thus an built feedback system serves one of the important purpose of an appraisal system that is to develop employees. It also improves communication and relation between employee and the supervisor and creates an atmosphere of trust and good will.

Row-8 shows the feedback policies follows by these labs. Three out of four labs have feedback rule only to communicate adverse observation. There was no provision or rule to communicate good or outstanding performance and observation. Such system is likely to fail to reinforce good behaviour and motivation. In Lab-C, there was an in-built mechanism for redressal of appraisee disagreement with appraisal scores. In Lab-D there was absolutely no mechanism to communicate either good or bad performance to the employee. Thus it adheres to the principle of confidential report ! Such systems are prone to build a very low trust environment.

Reward Contingency: Acceptance of a performance appraisal result by the appraisee and making them change their behaviour and performance are very much linked with the

reward contingency of the appraisal system. If an outstanding performance does not bring any reward or recognition, there is a very low probability that such behaviour will be repeated for long. A suitable reward conditional on a specific performance and behaviour is one of the most desirable quality of a good performance appraisal system. Row-9 of the table shows this reward contingency of the performance appraisal system in these labs.

In Lab-A , annual performance appraisal score is related with the minimum years of service required to attain eligibility for promotion to higher grades. After attaining eligibility, the actual promotion depends on three elements viz. performance appraisal score, peer review, and performance in the interview.

In Lab-B, the performance score is again linked with the minimum years of service required to attain eligibility. However, unlike in Lab-A, in this lab after one attain the eligibility to appear at the promotion interview, the annual performance appraisal score has no significance in the final promotion decision. This decision is based entirely on the performance of the candidate in the promotion interview.

In Lab-C there is no direct relation between annual performance score and the minimum years of service required to attain eligibility for promotion. This minimum years of service is same for all irrespective of one's performance. However, the assessing officer can recommend out of turn promotion or normal promotion or deferred promotion depending on his judgement. Thus while distributing organisational resource this organisation rely more on the judgement and discretion of the reporting officer. Because the reporting officer is more familiar with the job and the persons, a discretionary power to allocate reward to him/her is likely to yield better response from the employees than when this power is excised by others unfamiliar with the job and the context. However, because the actual relations are not explicit and known, it may suffer from the error of assumption and self-enhancing bias.

In Lab-D, there is absolutely no relation between performance and minimum years of service required to attain eligibility. Neither was there any discretionary power given to the assessors to recommend reward. The minimum years of service requirement is same for all irrespective of performance score. Once the eligibility is attained, the promotion depends entirely on the performance at the interview board. Thus individual may fail to relate their reward of promotion to their actual performance.

In summary we find the performance appraisal system in these organisation suffer from the following weaknesses.

i. **Performance measurement process does not provide any guideline on the meaning of the scale used to award the appraisal scores.**

ii. **Feedback system does not evoke a good participation of rank and file professionals in their appraisal process. In other words it is not a live exercise !**

iii. **Reward performance linkage are not explicit and are very weak.**

iv. **There is no in built audit system to check if the performance appraisal is serving its purpose or not.**

Table-4.2

Performance Appraisal System

Item	Lab-A	Lab-B	Lab-C	Lab-D
1. Input	Personal data, personal statement of work	Personal data, personal statement of work	Personal data, personal statement of work	Personal data, personal statement of work
2. What is assessed: Performance, behaviour or goal	Both performance and behavioural traits	Both performance and behavioural traits	Both performance and behaviour	Both performance and behavioural traits. Some goal is also set and measured
3. Weightage between performance and behaviour in the final score	Performance 75% Behavioural score 25% Same for all grades	Performance 60% Behavioural score 40% Higher grades gives more weight to behaviour.	The distribution is not explicitly written	The distribution is not explicitly written
4. Who does the assessment	Reporting officer	Reporting officer	Reporting officer	Reporting officer
5. Method of measurement	Graphic rating scale for both performance and behaviour Final score in %	Graphic rating scale for both performance and behaviour Final score in %	Performance in description and behaviour by Behaviourally anchored rating scale. Final score in 8 point scale	Essay method for both performance and behaviour. Final score on a 5 point scale
6. Verification of consistency	Checking done at two levels above the reporting level	Checking done at three levels above the reporting level	Checking done at two levels above the reporting level for lower level jobs but at three level for Grade-5 and above	Checking done at two levels above the reporting level

Continued-----

Table 4.2 continued-------

7. Frequency of measurement	Once a year	Once a year	Once a year	Once a year. However, the guideline emphasises continuous monitoring.
8. Feedback mechanism	Only adverse remarks are communicated	Only adverse remarks are communicated	Only adverse remarks are communicated There is a redressal mechanism also	No feedback system is there.
9. Reward contingency	Performance appraisal score is directly related to eligibility for promotion. However, Only 30% of the appraisal score is counted in promotion.	Performance appraisal score provides only eligibility. Promotion depends entirely on assessment by promotion committee.	Performance appraisal score is not directly linked with promotion eligibility. But assessing officer can recommend promotion both out of turn and normal.	No relation between appraisal score and eligibility to appear in promotion interview. Promotion depends entirely on the assessment of the promotion committee.

Section 4.3: Promotion Policy and Incentive for Superior Performance

Promotion policies of an organisation are a powerful tool to influence performance and evoke desired behaviour among the employees. It is through these policies the organisations convey its priorities and importance of acceptable and unacceptable actions and behaviour. Good performance based promotion policies also build a culture that encourages risk taking and innovation on the part of the employees. A clear and well-documented policy for promotion and performance recognition is very important because it reduces the uncertainty and ambiguity from the minds of the employees about how their career would progress in the organisation. Thus the importance of a well-documented promotion and performance recognition policy cannot be over emphasised.

i. Normal Promotion Time With Minimum Acceptable Score

Table-4.3A shows the normal promotion time with minimum acceptable performance appraisal scores in different laboratories. It can be seen that the minimum service requirements are not same in all the organisations. They vary across organisation and across grades also. Though they are same in all grades of Lab-A. Among the four labs, the promotion policy seems to be quite liberal in Lab-C while it is quite restrictive in Lab-B. The first promotion with minimum performance may take as long as 7 years in Lab-B while one could get it in 4 years in Lab-C. This minimum service requirement rises as one move up in the hierarchy.

ii. Relation between performance appraisal Score and Service Experience Requirement

All the four organisations have well documented promotion policies that are based on three factors viz. annual performance appraisal score, years of service in the current post, and performance in the interview board. However, the first two factors are used as a kind of hurdle in many organisations. Once these minimum hurdles are crossed the final outcome does not depend on the performance in these criteria. The minimum score requirement in the first two factors viz. performance and service are interrelated

and this relations are often given as a part of the promotion policy in some organisation while in others it is left entirely to the discretion of the management.

Table-4.3B shows the interrelation between performance and minimum years of service requirements to attain eligibility for appearing at the promotion interview. The first thing to note here is that neither the performance requirement nor the service requirements are related to any academic attainment. Thus the promotion policy effectively de-links the academic qualifications from performance in higher level jobs. It discourages people from acquiring higher academic qualifications. Thus the system fails to reflect the growing complexities of technology and the importance of conceptual and analytical skills at higher level jobs. Such conceptual understanding can be built more effectively through on the job training rather than on the job training. The promotion policy could play a very important role in emphasising the importance of this type of training and learning by linking promotion with acquisition of higher academic qualifications.

However, one reprieve to this is that people have the choice to apply for higher level jobs at any time in their career. As was noted in Section4.1 during such open recruitment, the experience requirement adjust downward with the increase in academic qualification of the candidates. Thus even though the promotion policies does not recognise and reward higher qualification, direct recruitment in mid-level recognises the importance of these qualifications. This effectively encourages the professionals to acquire higher academic degrees.

The relation between performance and service years' requirement to attain eligibility to appear for interview indicates two labs. Viz. Lab-C and Lab-D do not have any explicit policy to link performance with years of service requirement. Thus the scientists in this organisation do not know how and what types of performance are counted for faster promotion.

Reduction of minimum service requirement based on superior performance can be considered as a kind of reward. Because it will encourage people to show superior performance. Absence of any clear-cut policy along this line may create doubt about whether and how good performance are rewarded and if so whether it is followed consistently and fairly.

Both Lab-A and Lab-B have explicit policy to encourage and reward superior performance. In Lab-A, the minimum performance requirement is 60% to attain eligibility for review after 5 years. However, if one shows 80% in performance then this service requirement for review is reduced by one year to make it 4 years and with performance 90% this requirement is reduced to 3 years.

Thus in terms of rewarding superior performance, the service requirement is reduced by 1 year if performance exceeds the minimum by 20 points. The rule is similar in Grade-2 also. In Grade-3, the minimum performance requirement is increased to 70% to attain eligibility in 5 years. Thus performance requirement is raised in upper level positions.

The policy in Lab-B is slightly different. Here the minimum performance requirement to attain eligibility is 60% like that of Lab-A. However, the corresponding years of service requirement is 7 years compared to 5 years in Lab-A. The minimum years of service requirement is reduced by 1 year for every 5% increase in performance over the Minimum. However, unlike Lab-A, the performance requirement is 82% to attain eligibility in 3 years, which is a fast-track promotion. The requirement of performance and service changes slightly as one moves up in the hierarchy. As in Lab-A the minimum performance requirement rises in higher grades. There was also no explicit policy on performance and service requirement for Grade-5 and above.

Looking at the promotion policies in Lab-A and Lab-B, we see that both the labs follow explicit policy of telling the personnel on the minimum performance requirement to attain eligibility for promotion. The only difference between the two is that with minimum the service requirement is higher in lab-B than that in Lab-A.

ii. Promotion Policies and Financial Incentive for Superior Performance

Table-4.3C shows the financial incentive for promotion to next higher grade from Grade-1 when a person gets it at the shortest possible time based on annual performance appraisal score. For the purpose of comparison we have also shown the corresponding incentive for acquiring higher academic qualification and joining in higher grade by competing directly.

In Lab-A and Lab-B one can get promotion after 3 years of service in Grade-1. In Lab-C, one can get promotion after 2 years of service. And, in Lab-D one can get

promotion to next higher after 8 years of service. Using the normal yearly increment as the source of salary growth, we find the financial incentive for superior performance is 23.7% in Lab-A and in Lab-B, 27.6% in Lab-C and 7.1% in Lab-D. The corresponding incentive for higher academic degree of Masters in Engineering or M.Phil. in science are 20% in Lab-A, 13.2% in Lab-B and in Lab-C and 23.3% in Lab-D respectively (This has been calculated by taking the basic salary that one would have got had he/she not gone for the corresponding higher degree)

Thus among the four labs the incentive for superior performance is best in Lab-C and worst in Lab-D. The financial incentive for superior performance is better than the financial incentive for next higher academic degree of Masters in all the labs except Lab-D. The difference between the financial incentives for performance and higher education is best in Lab-B and worst in Lab-D

In summary, we find the promotion policies in some labs links performance with minimum service requirement thereby encouraging the personnel to achieve better performance. Some labs do not have any written policy for encouraging superior performance though they practice it. The promotion policies indicate the financial incentive for showing superior performance varies from a low of 7.1% to a high of 27.6%. Except in one lab, in general the financial incentive for performance is more than a corresponding incentive for educational qualification above the basic degree.

Table-4.3A

Normal Promotion Time with Minimum Acceptable Performance Appraisal Scores

Grade	Lab-A	Lab-B	Lab-C	Lab-D
1	5 Years	7 Years	4 Years	8 Years
2	5 Years	9 Years	4 Years	8 Years for Ph.D. 16 Years for Bachelors
3	5 Years	9 Years	4 Years	No promotion from this grade
4	5 Years	7 Years	5 Years	Not applicable
5	5 Years	Unspecified	5 Years	Not applicable
6	5 Years	Unspecified	5 Years	Not applicable

Table-4.3B

Performance threshold for getting promotion after experience in the organisation

Grade	Education	Work Experience in organisation	Performance required in Lab-A	Lab-B	Lab-C	Lab-D
1	All	3	90%	82%	Unspecified	Unspecified
		4	80%	77%	-------	-------
		5	Min 60%	70%	-------	-------
		6	-----	65%	-------	------
		7	-----	Min 60%	-------	------
2	All	3	90%	90%	Unspecified	Unspecified
		4	80%	85%	-------	-------
		5	Min 60%	80%	-------	-------
		6	------	75%	-------	-------
		7	------	70%	-------	-------
		8	------	65%	-------	-------
		9	------	Min 60%	-------	-------
3	All	3	90%	90%	Unspecified	Unspecified
		4	80%	85%	-------	-------
		5	Min 60%	80%	-------	-------
		6	------	75%	-------	-------
		7	------	70%	-------	-------
		8	------	65%	-------	-------
		9	------	Min 60%	-------	-------
4	All	3	90%	90%	Unspecified	Not Applicable
		4	85%	85%	-------	
		5	Min 75%	80%	-------	
		6		75%	-------	
		7		70%	-------	
5	All	5 No fast track	Min 75%	------	------	------
6	All	5 No fast track	Min 75%	-----	-----	-----

Table-4.3C

Promotion policy and incentive for superior performance and for higher educational qualification.

Percentage gain in salary over others with poor performance *

Incentive for	Grade	Lab-A	Lab-B	Lab-C	Lab-D
Superior Performance	1	23.7%	23.7%	27.6%	7.1%
ME/ M.Phil**	1	20%	16.5%	20%	23.3%
Ph.D(Sc)**	1	16.5%	7.14%	16.5%	23.3%
Ph. D. (Eng)**	1	16.5%	4.3%	13.2	----

*Assuming that one gets promotion to next grade in the shortest possible time based on performance.

** Assuming that it takes two years to acquire a Masters degree and four years to acquire a Ph. D. in science and five years to acquire a Ph.D in Engineering after the Graduate degree

Section 4.4: General Characteristics of Current Manpower

i. Human capital Intensity in the Current Manpower

Table-4.4A shows the educational composition of the current pool of scientists working in the four labs. This is also shown in Fig-4.4A. From this table, it can be seen that percentage of Ph.D.'s in Lab-A, Lab-B, Lab-C and Lab-D were 33.4%, 5.9%, 3.7% and 87.7% respectively. The percentages of Masters degree holders were 33.3%, 45.8%, 31.8% and 1.9% respectively.. Thus the mission oriented research organisations of Lab-B and Lab-C have quite a small percentage of Ph.D. in their current pool. Inspite of very attractive recruitment policies to recruit Ph.D.'s with starting Grade one grade above the entry grade of Bachelors, Lab-C could not attract or build very many Ph.D. On the other hand Lab-A using the same pay scale could attract quite a good number of Ph.D. This highlights the point that success or failure to attract high level manpower depend very much on many factors pay scale is only one them. Organisational culture matter and job structure possibly plays a very important role.

In mission oriented research program, individual work in a team. Individual achievement and contribution in such environment is less visible. It has been found that scientists and technologists generally enjoy working in environment where they can identify their contribution to the organisational goal without too much labour. It is possibly this factor which makes Lab-B and Lab-C less attractive to scientists and technologist.

ii. Age of Entry in the Organisation:

Table-4.4B shows the means and mode of age of entry of the scientists in their respective organisations. The average age of entry was 27.4 years, 25.9 years, 26.3 years and 27.3 years in Lab-A, Lab-B, Lab-C and Lab-D respectively. These trends are shown in Fig-4.4B. Thus the average age of entry was quite high in Lab-A and Lab-D while it was relatively low in Lab-B or Lab-C. This indicates that most of the new recruits in Lab-B and Lab-C are lower qualified professionals and are just fresh from college with very little work experience elsewhere. This means though there was policy to attract more qualified and experienced professionals, yet neither of these two labs was very successful in making such recruitment.

iii. Age and Work Experience of the Current Pool

Table-4.4C and Table-4.4D show mean and median age and organisational work experience of the current pool of scientists in the four organisations. The average age of the current pool of scientists were 44.5 years, 44.1 years, 41.5 years and 51.4 years in Lab-A, Lab-B, Lab-C and Lab-D respectively. The corresponding median ages were 47.4 years, 45.8 years, 40.4 years and 52.9 years in Lab-A, Lab-B, Lab-C and Lab-D respectively. These trends are shown in Fig-4.4C and Fig-4.4D. Thus, it appears Lab-A and Lab-D have high percentage of professionals with quite a high age. This means renewal of talents and skills are place very effectively in this organisations. Unless this process are activated and maintained, the ability of these organisations to generate new technology and new ideas may fall to a very low level.

This is further shown in Table-4.4D in terms of distribution of organisational experience. The median value of organisational experience was 19.8 years,, 17.3 years,

13.4 years and 26 years in Lab-A, Lab-B, Lab-C and Lab-D respectively. Thus in Lab-A, 50% of the currently working scientists are more than 20 years and in Lab-D, more than 50% are working 26 years and above. These highly experienced people are very productive only when get opportunity to develop and guide others of younger age. High median age indicates that this opportunities are very limited.

This high median age of the current pool is another major cause of concern in terms of need for fresh recruitment. As is shown in Table-4.4E, the percentage of people who joined in the last 5 years were 20% in Lab-A, 11% in Lab-B, 15.5% in Lab-C and 3% of current pool in Lab-D. This is also shown in Fig-4.4E. Now given that median age is 47 Years in Lab-A, at least 50% of the current scientists and engineers would be retiring in next 13 years. As shown in Section 48, the current rate of recruitment is about 4% a year. Thus at the current rate, this lab can just barely meet its natural loss of manpower without taking into account the loss due to voluntary change of job.

In Lab-B, the median age is 46 years, so about 50% new recruits must join in next 14 years. Given that in last 5 years, it could get only 11% new engineers, it is obvious that it will be impossible for this lab to meet its normal manpower requirements without a radical change in its policies and practices. This does not include loss by resignation, loss due to obsolescence etc.

In Lab-C, the median age is 40 years. So in next 20 years, it has to make at least 50% new recruits. Its rate of recent recruitment is 15.5% in last five years. Thus in terms meeting its manpower loss due to natural cause, this lab is likely to manage well unless the loss due to voluntary resignation become too high.

The median age of the current pool is 53 years in Lab-D. Its rate of recent recruitment is just 3% in last five years. In next 7 years it will have recruit at least 50% new professionals from the market. Given its past rate of recruitment, it is quite unlikely to do much better unless the changing economic condition provides a helping hand.

In summary, we find all the four labs are under considerable pressure to recruit adequate number of new recruitment from market. With the existing pay scale and other career policies it is not able to meet its regular manpower requirements. The situation is very very critical for some labs where the median age of the currently working scientists are quite high. In terms of quality of manpower, the mission oriented labs suffer over the project oriented labs. The percentage of Ph.D.'s in these labs are quite small compared to other labs.

Table-4.4A

1. Human Capital Intensity of the Current Pool

% of Total

Education	Lab-A	Lab-B	Lab-C	Lab-D
Ph.D.	33.4%	5.9%	3.7%	88.2%
ME	33.3%	45.8%	31.8%	
B.E or Eq	33.3%	48.3%	64.5%	11.8%

Table-4.4B

2. Average Age of Entry

Education	Measure of	Lab-A	Lab-B	Lab-C	Lab-D
All	Mean	27.4	25.9	26.32	27.3
	Mode	25 (47)	24 (40)	23 (92)	25 (67) 26
BE	Mean	26.1	25.9	26.5	26.2
	Mode	24	24	24	27
ME	Mean	26.3	25.6	25.7	---
	Mode	25	24	26	---
Ph.D.	Mean	29.7	28.3	28.2	27.4
	Mode	27	27	27	25

( ) Number of persons at the mode

Table-4.4C

3. Age Distribution of Current Pool:

Measure of	Lab-A	Lab-B	Lab-C	Lab-D
Mean	44.5	44.5	41.5	51.4

Table-4.4D

4. Distribution of organisational work experience

Measure of	Lab-A	Lab-B	Lab-C	Lab-D
Mean	17.1	18.2	15.2	24.1
Median	19.8	17.3	13.4	26.0

Table-4.4E

5. Total number of professionals in each lab and the percentage of recent recruits of last five years.

% of Total

Quantity	Lab-A	Lab-B	Lab-C	Lab-D
Total pool	303	203	490	608
Recent recruits of 5 years	60	23	62	18
Percentage of recent recruit in the total	20%	11%	12.6%	3%

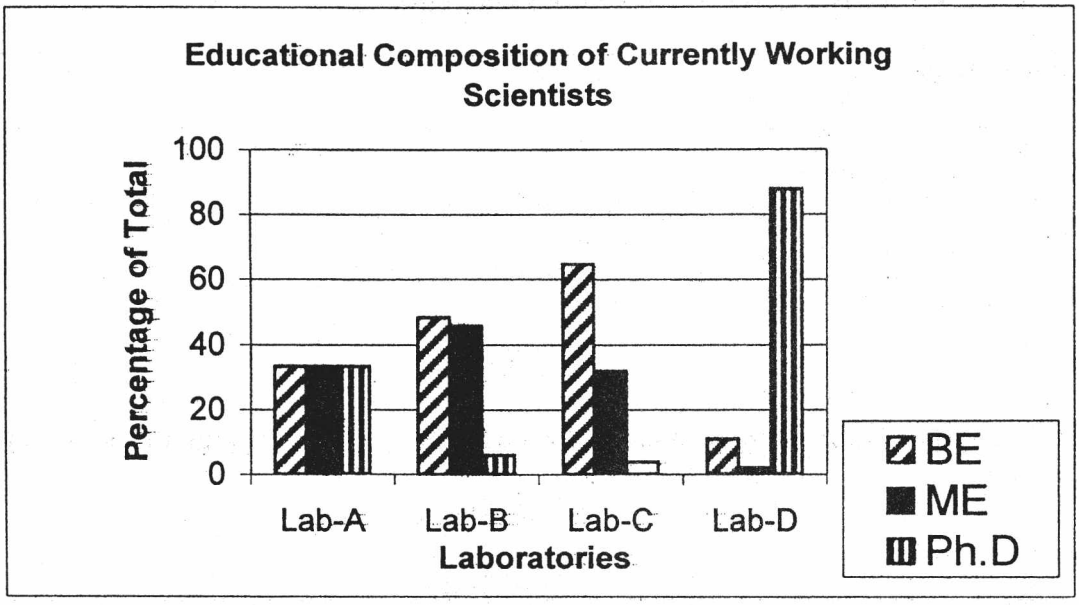


Fig-4.4A

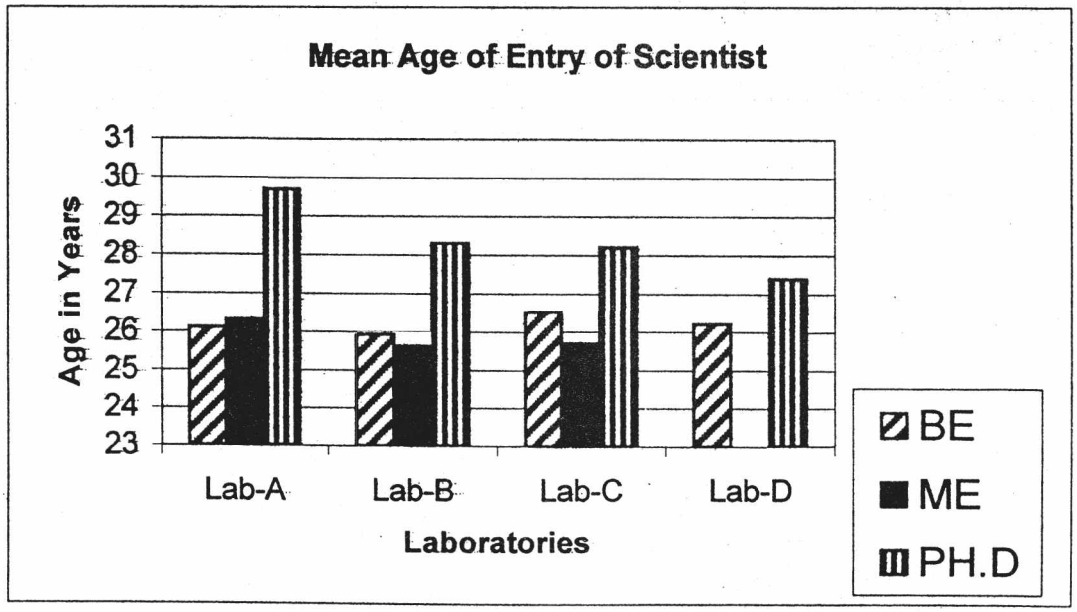


Fig-4.4B

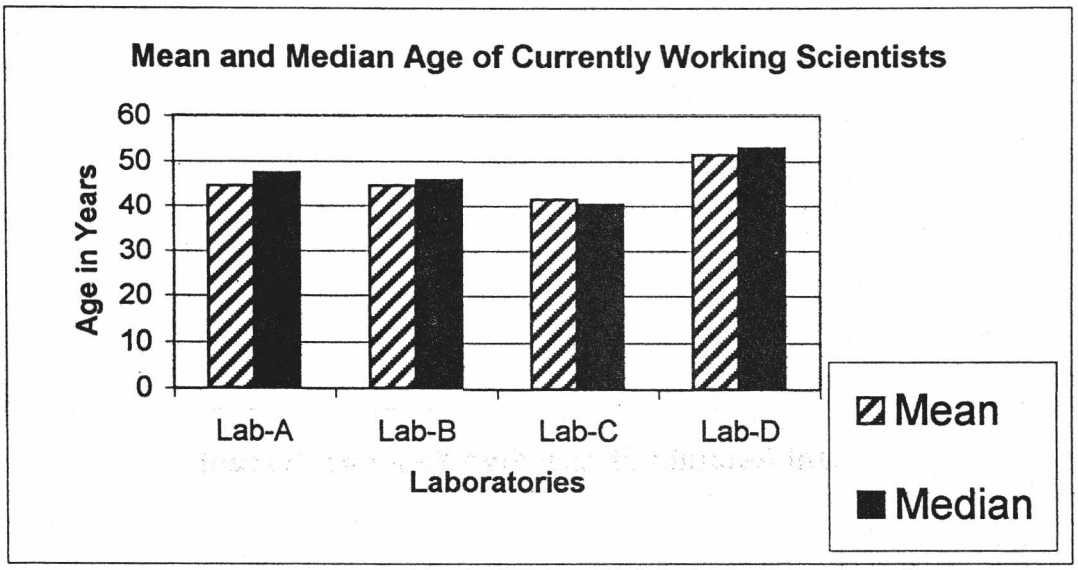


Fig-4.4C

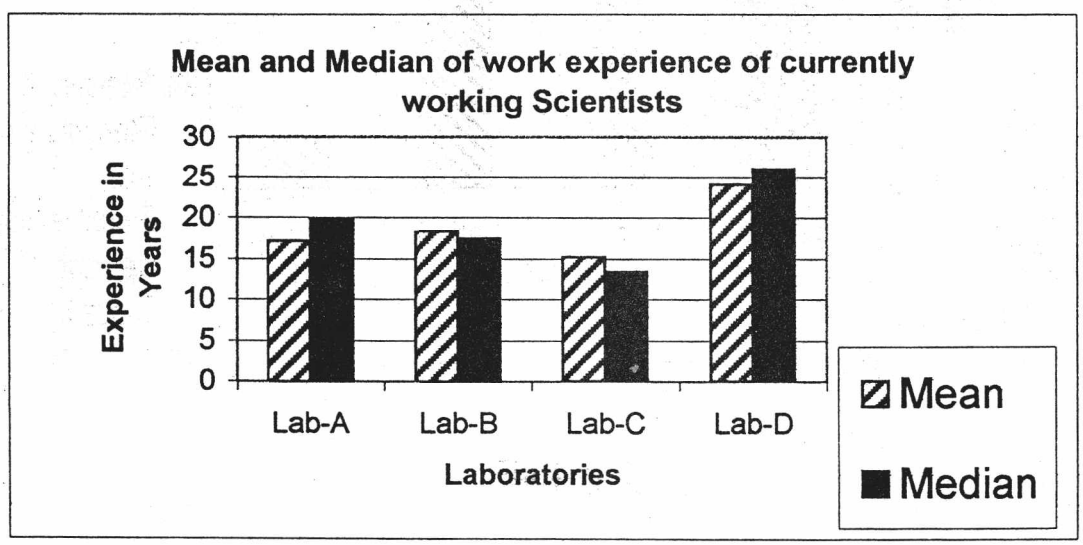


Fig-4.4D

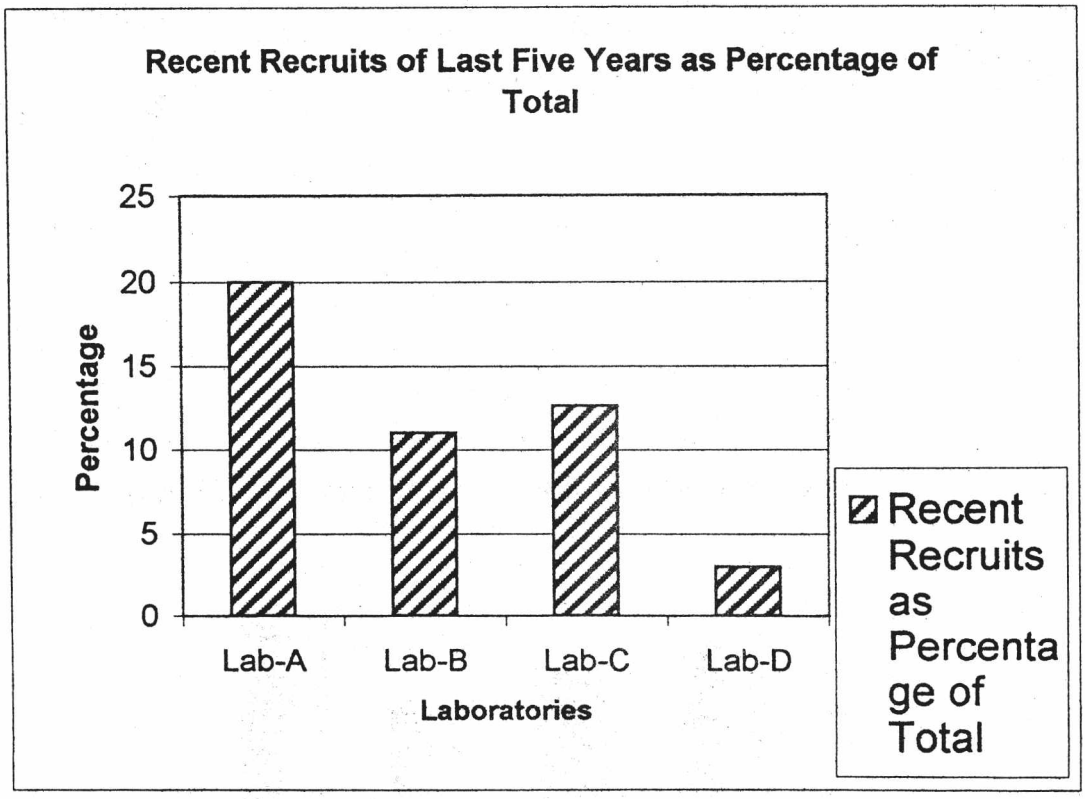

Recent Recruits of Last Five Years as Percentage of Total
25
20
15
10
5
0
Percentage
Lab-A
Lab-B
Lab-C
Lab-D
Laboratories
Recent Recruits as Percentage of Total

Fig-4.4E

Section 4.5: Growth of Salary and Grade with Age

i. Average Grade in Different Age Groups

Table 4.5A shows the average grade of current pool of professionals in different age groups in different labs. We have chosen the age groups of 24-26, 34-36, 39-41 and 44-46, 49-51 and 54-56 to compare the grades across organisations. These trends are shown in Fig-4.5A.

The average grade of professionals in the age group of 24-26 was 1, 1, 1.26 in Lab-A, Lab-C and Lab-D respectively. The average grade in the age group of 34-36 years was 1.9, 2.53, 2.56 and 2.78 years respectively in Lab-A, Lab-B, Lab-C and Lab-D respectively. Thus the change in the average Grade in the first 10 years of career was about 0.9, 1.53, 1.56 and 1.52 in Lab-A, Lab-B, Lab-C and Lab-D respectively. Thus between this four labs, the change in grade in lab-A was considerably less than in the other three.

The average grade in the age group of 44-46 years was 3.8, 3.7. 3.3 and 3.6 respectively. The change in grade in the second 10 years of one's career was 1.9, 1.2, 0.7, and 0.8 in Lab-A, Lab-B, Lab-C and Lab-D respectively. Thus in the second 10 years of career the growth was highest in Lab-A and lowest in Lab-C. Thus the slow growth in the first phase seems to be compensated by a faster growth in the second phase. However, such correction in later career may not be very effective to hold back the frustration of the professionals. As we have noted in Chapter-2, the career growth in the first 10 years is a very crucial phase in one's decision to stay in an occupation or organisation. When career growth is not according to expectation in this phase, they think for alternative career or organisation that eventually lead to a search for a better career and better organisation.

It should be kept in mind that low average grade does by no means prove that average promotion rates are slow. It could very well be that some of the people actually reached their current grades at a fast rate but after reaching there they are stagnating over a long period. A better parameter would be to compare the age at which they reached their current grades. This is shown in Table4.5B.

ii. Average Age of Reaching the Current Grades

Table-4.5B shows the average age at which the currently working professionals reached their current grades. In other words this is the reflection of promotion policies that is practised presently. Because Grade-2 and Grade-5 were not valid Grades in Lab-D, there was no data for Lab-D for these grades. These trends are shown in Fig-4.5B

The average age at which Grade-2 was reached was 32 years, 34.8 year and 32.1 years respectively in Lab-A, Lab-B and Lab-C respectively.

Thus the average age to reach grade-2 in Lab-A and Lab-C seem to be quite comparable while that in Lab-B is slightly higher. This means the first promotion is taking place at relatively slow rate in Lab-B than those in Lab-A or Lab-C.

The average age to reach Grade-3 were 41.4 years, 42.1 years, 36.1 years and 38.5 years in Lab-A, Lab-B, Lab-C and Lab-D respectively. In the recent past the rate of promotion in Lab-C and Lab-D was relatively faster than that in Lab-A and Lab-B. The average age to reach Grade-3 in Lab-B was highest. This means currently working Grade- scientists of Lab-B moved up at relatively slower rate than those in Lab-A, Lab-C or Lab-D. Because this was a cumulative effects from past promotion rates so higher age in the current grade could be the effect of slower promotion in the past. This is shown more clearly for Grade-5 where the average age to reach was 48.5 years, 48.9 years and 44.6 years in Lab-A, Lab-B and Lab-C respectively. **Thus cumulatively, both in the past and in the present, the promotion rates were best in Lab-C and worst in Lab-B.**

iii. Rate of Growth of Salary with Age

Table-4.5C shows the average salary of R & D professionals in different age groups in four labs. These trends are shown in Fig-4.5C. This table shows that in age group of 34-36 the average monthly basic salary was Rs3306, Rs3518, Rs3594 and Rs3038 in Lab-A, Lab-B, Lab-C and Lab-D respectively. This shows that variation in average salary between the four labs is more than two yearly increments for Grade-2 which is average grade in this age. The salary competition is far from true though there is more or less competitive salary between Lab-B and Lab-C. In the age group of 34-36 years, the average salary is lowest in Lab-D and highest in Lab-C. This is partly due to the fact that the average age of joining of the fresh recruits in Lab-D is higher than that of the other

labs. Most scientists in Lab-D joins service after acquiring their Ph.D. which takes a lot of their service time. This is possibly one of the reason for lower average salary for scientists in Lab-A. Thus in the first phase of career we find the distribution of average salary in different organisation is a clear reflection of the academic qualification requirements for regular employment in different organisation. Unless this early career sacrifice is compensated at point of entry a feeling of inequity can build from day one of ones service in the organisation and can be the cause of considerable overt or covert unrest among the scientist.

In the first phase of career, the difference in average salary due to a difference of 10 years in age was Rs1106 in Lab-A, Rs1318 in Lab-B, Rs1394 in Lab-C and Rs838 in Lab-D. In the second phase of career after 35 years of age, the difference in average salary due to difference in age of 10 years was Rs1022 in Lab-A, Rs1297 in Lab-B, Rs885/- in Lab-C and Rs2059/- in Lab-D respectively. Thus the slow growth in salary in the first stage was made up to a considerable extent by a relatively fast growth in the second stage in Lab-D. However, due to slower growth in salary in later stage of career in Lab-B, the average salary in the age group of 54-56 years is considerably less than those in other three. The average salary in this age group was Rs5680/- in Lab-A, Rs5180 in Lab-B, Rs6048/- in Lab-C and Rs5607/- in Lab-D. Thus our contention that average salary across organisation even with the same grade structure and pay scales are not competitive is well supported by the data.

iv. Estimation of Salary Growth Equation

Table 4.5D shows the estimation of monthly basic salary by least square method using educational qualification, work experience in the organisation, work experience prior to joining the organisation and years working in the current grade as explanatory variables in a human capital framework. Because we have only three well demarcated educational qualifications for the sample population we have used two dummy variables to represent the educational qualification. Ln of Monthly Basic Salary was used as the dependent variable. From the table it can be seen that the explanatory power of the model varies from a low of 0.58 in Lab-D to a high of 0.90 in Lab-C. A low explanatory power of human capital based variable of educational qualification and work experience, indicates that in those organisations the actual career growth and salary are very much

linked with actual assessment of performance and promotion. A high explanatory power of this regression equation means career growth is mostly due to accumulation of human capital which is an indicator of potential performance.

In Lab-A, about 74% of the variation in salary can be attributed to mainly the variation of educational qualification, organisational experience in years, years of experience prior to joining the organisation and years working in the same rank. In Lab-B, Lab-C and Lab-D these explanatory powers are 75%, 90% and 58% respectively. This means in Lab-A about 26% of variations in salary could be due to actual performance as observed by the organisation and recognised by the management. This unexplained part is as much as 42% in Lab-D. A high unexplained component in salary equation means actual performance measurement and evaluation plays a very important role in this organisation. A high explanatory power of 90% in Lab-C indicates that annual performance appraisal system and promotion policy possibly does not play very important role in shaping the variation of earning of the manpower. Of course to some extent this high explanatory power could be attributed to the use highly over lapping pay scales for the scientists. Even a fast track promotion may not yield a any significant change in one's income.

The coefficient of educational qualification of Masters in engineering varies from low of 0.0334 in Lab-C to a high of 0.0772 in Lab-A. This indicates on the average personnel with Masters in engineering earns about 3.34% more than a Bachelors in engineering in Lab-C, 7.3% more in Lab-B and 7.72% more in Lab-A. The coefficients of educational qualification of Ph.D. dummy is 0.2704 in Lab-A, 0.1243 in Lab-B, 0.1423 in lab-C and 0.0831 in Lab-D. All these coefficients are highly significant statistically. This indicates in Lab-A, a Ph.D. degree holders earns on average of 27.04% more, in Lab-B 12.43% more, in lab-C 14.23% more and in Lab-D 8.31% more than a Bachelor degree holder.

The coefficient of organisational experience is 0.044 in Lab-A, 0.0405 in Lab-B, 0.0536 in Lab-C and 0.0723 in Lab-D. This indicates that in the beginning of career the average growth rate of salary due to growth in work experience in the organisation is 4.4% in Lab-A, 4.1% in Lab-B, 5.4% in Lab-C and 7.23% in Lab-D respectively.

However, this rates go down as one works more number of years in the organisation. This is evident by the negative coefficient of the square of organisational experience.

The coefficient of prior work experience was 0.019 in Lab-B, 0.0091 in Lab-C and 0.017 in Lab-D respectively. Due to non-availability of data on prior experience in the data file of Lab-A, this variable could not be included in the regression equation for Lab-A. The estimated coefficients for prior work experience in all the other three equations were statistically significant. This indicated that the present salary of the scientist were higher by 1.49% for every year of prior work experience that the scientist had when they joined in Lab-B, 0.91% higher in Lab-C and 1.7% higher in Lab-D respectively. Thus the growth of salary due to increase in organisational experience was relatively more than similar experience acquired in some other organisation.

Table-4.5E shows the estimated salary of Bachelors, Masters and Ph.D.'s after different number of years of service in the organisations. These trends are shown in Fig-4.5E1, Fig-4.5E2 and Fig-4.5E3 for Bachelors, Masters and Ph.D. respectively. From this trend line it can be seen that non-competitive salary exit both in the first phase as well as the last phase of one's career.

In summary, we find career both in terms of average grade, as well as salary were not competitive across organisations. The average financial incentives for educational qualification above the basic degree was also quite different in different labs. The effect of work experience prior to joining the organisation on current basic salary was considerably less than a corresponding experience acquired from within the organisation.

Table- 4.5A

Growth of Grade with Age

Average Grade

Age group in Yrs	Lab-A	Lab-B	Lab-C	Lab-D
24-26	1	----	1	1.26
34-36	1.9	2.53	2.56	2.78
39-41	3	3.3	2.9	3.16
44-46	3.8	3.7	3.3	3.6
49-51	4.0	3.9	4.4	3.6
54-56	4.3	3.5	5.2	4.0

Table-4.5B

Average Age to attain different Grades

Average Age in Years

Grade	Lab-A	Lab-B	Lab-C	Lab-D
2	32	34.8	32.1	-----
3	41.4	42.1	36.1	38.5
4	45.3	45.9	41.5	45.5
5	48.5	48.9	44.6	--------

Table-4.5C
Growth of salary with age

Salary in Rs

Age group Yrs	Lab-A	Lab-B	Lab-C	Lab-D
24-26	2275	-	2292	-
34-36	3306	3518	3594	3038
39-41	4130	4342	3828	3727
44-46	4328	4815	4479	5197
49-51	5216	5248	5504	5371
54-56	5680	5180	6048	5607

Table-4.5D
Regression Estimate of Salary Growth equation

Dependent Variable = Ln of Monthly Basic Salary

Independent Variables	Lab-A	Lab-B	Lab-C	Lab-D
Intercept	7.759	7.80	7.72	7.423
Education ME Dummy	0.0772 (3.54)	0.073 (3.51)	0.0334 (3.37)	------
Education Ph.D. dummy	0.2704 (12.20)	0.1243 (2.71)	0.1423 (5.74)	0.0831 (3.62)
Organisational experience	0.044 (12.14)	0.0405 (8.82)	0.0536 (24.55)	0.0723 (12.45)
Square of organisational experience	-0.0006 (6.25)	-0.0005 (4.33)	-0.0006 (7.72)	-0.0012 (9.19)
Prior experience	-----	0.0149 (6.68)	0.0091 (3.22)	0.017 (6.58)
Years in the same post	-0.0036 (0.91)	-0.005 (0.75)	-----	0.0023 (1.21)
R^2	0.74	0.75	0.90	0.58

Table-4.5E

Estimated salary of professionals after a few selected number of years of experience in the organisation

Education class	Years since BE	Lab-A	Lab-B	Lab-C	Lab-D
Bachelors only	5 Yrs	2875	2951	2901	2332
	10 Yrs	3426	3481	3626	3059
	15 Yrs	3960	4004	4398	3780
	20 Yrs	4443	4492	5177	4398
Masters	5	3106	3175	3000	-----
	10	3700	3744	3749	-----
	15	4278	4307	4548	----
	20	4799	4832	5353	----
Ph.D.	5	3768	3342	3345	2534
	10	4489	3941	4181	3325
	15	5189	4534	5071	4108
	20	5822	5086	5969	4780

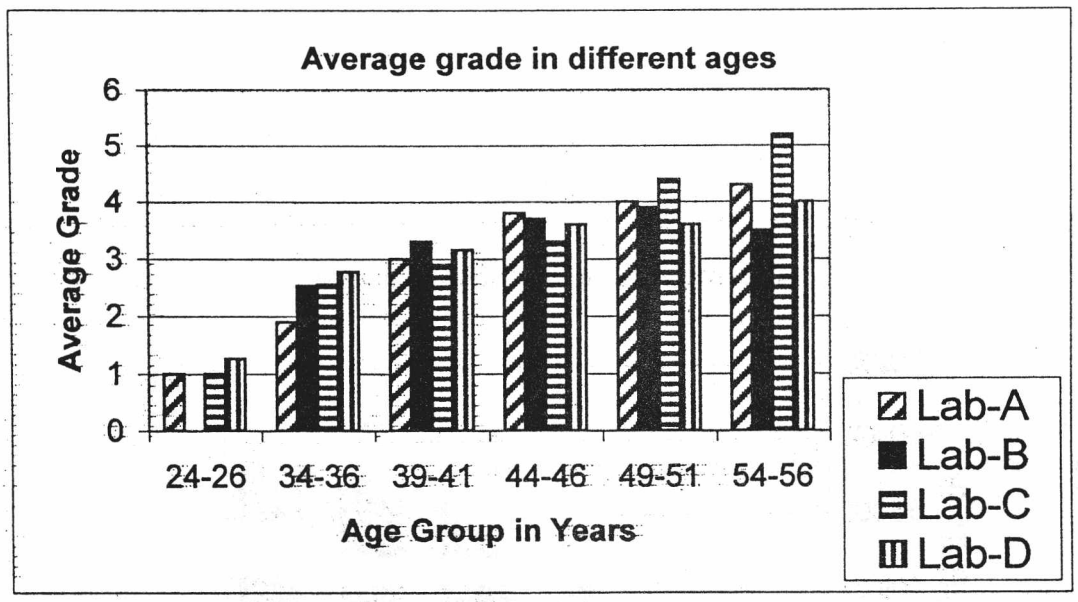


Fig- 4.5A

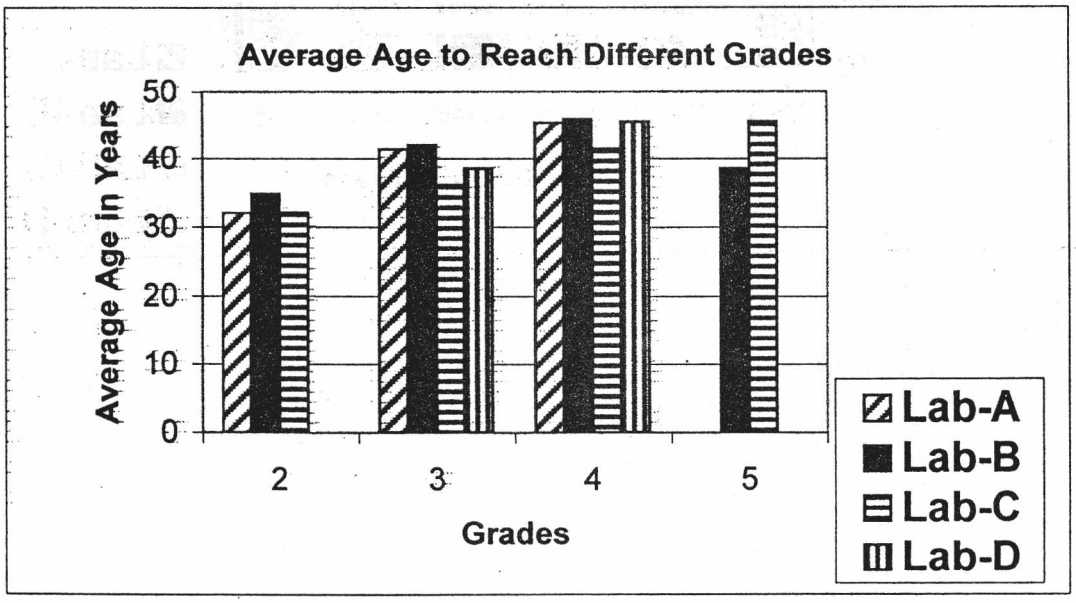


Fig-4.5B

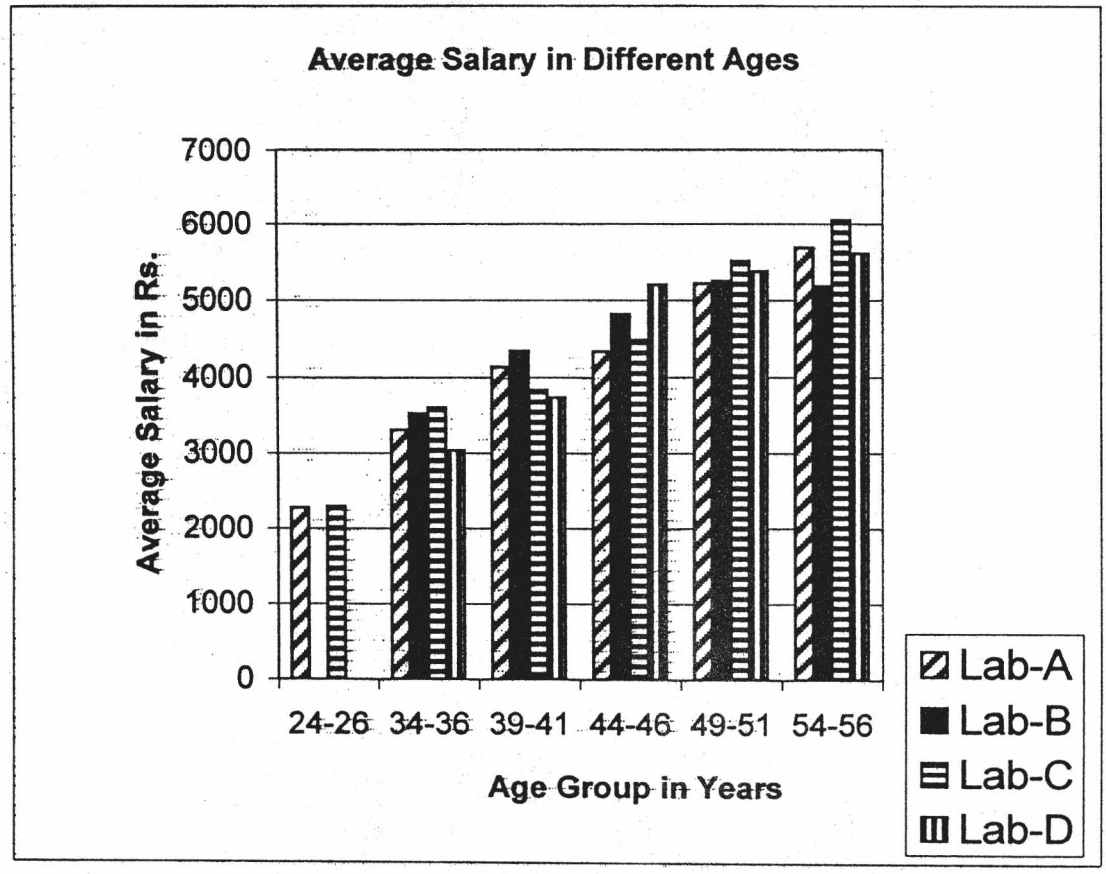

Average Salary in Different Ages
7000
6000
5000
4000
3000
2000
1000
0
Average Salary in Rs.
24-26
34-36
39-41
44-46
49-51
54-56
Age Group in Years
Lab-A
Lab-B
Lab-C
Lab-D

Fig-4.5C

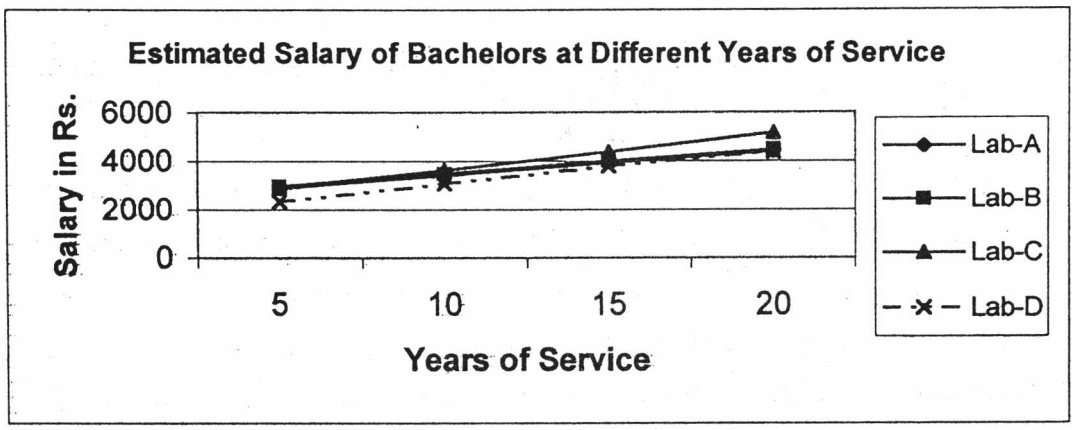


Fig-4.5E1

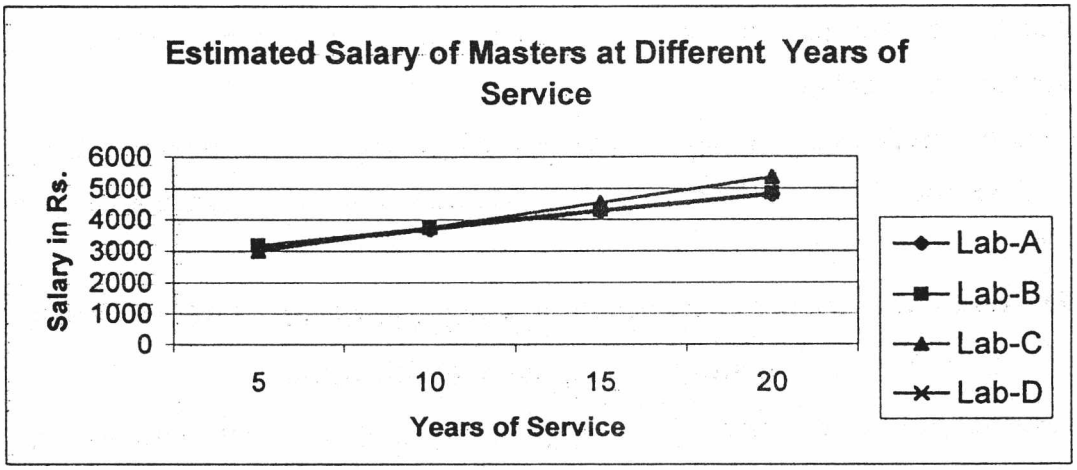


Fig-4.5E2

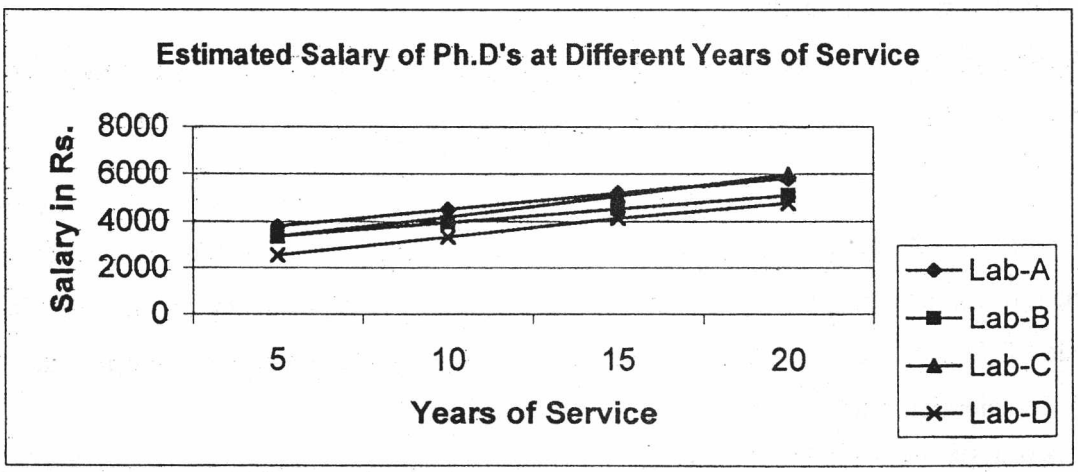


Fig-4.5E3

Section- 4.6 Career Difference due to difference in Academic Qualification

In view of the requirement of more formal knowledge and training for a satisfactory performance in R&D setting, most organisation prefer to recruit more qualified professionals. In Section-4.1, we have talked about the explicit policies followed by various organisations to send appropriate signal to the market to recruit higher qualified professional. However, the mere existence of a policy is not enough, the actual practice and career outcome of more qualified professionals are the most important indicators. It is this actual practice and the corresponding career outcome of qualified professional are the principal input in forming image and perception about an organisation and its policy.

In this section we have looked at the educational composition of professionals in different labs and their career outcome in terms of grade, salary and stagnation in current grade.

i. Present composition of Manpower and Opportunities of in-house Acquisition of Higher Qualification

Table 46A shows the present educational composition of the current manpower in the organisation. These trends are shown in Fig-4.6A. As we have noted in Section 4.4. Lab A and Lab-D have fairly good numbers of higher qualified professional. Lab-B and Lab-C have very small number of Ph.D.s.

ii. Average Age of Acquiring of BE, ME & Ph.D. and the Percentage of Scientists who acquired in-house.

The average age at which a degree was acquired is an indicator about when a degree was acquired - whether it was acquired before starting employment or after joining their current job. Because the year of acquiring BE, ME and Ph. D were not available in the data file of Lab-A and Lab-B, we have used the survey data to get an estimate of year at which the scientists acquired their Bachelor qualification.

Table-4.6B shows the average age at which the current population acquired their qualifications. This table shows BE was acquired at an average age of 23.9 year in Lab-A, 21.8 year in Lab-B, 23.5 Year in Lab-C and 22.4 year in Lab-D respectively. Masters

was acquired at an average age of 26.1 year in Lab-C. Ph. D was acquired at an average age of 34 years in Lab-C and 32.4 years in Lab.-D. The year of acquisition of ME and Ph.D. in Lab-A & Lab-B was not available in their record nor could we get it in our survey. The average age of normal acquisition of Masters and Ph.D. in Lab-A was assumed to be 25 and 27 years respectively. The average age to acquisition Masters and Ph.D. in Lab-B was assumed to be 24 and 27 years respectively. These trends are shown in Fig-4.6B.

It was assumed that when a person joined before attaining the average age of acquiring the last qualification, he did so only from within the organisation. In Lab-A and Lab-B this technique was used to calculate the percentage of people who acquired their last qualifications from within the organisation. The high average age of acquiring BE in Lab-A and Lab-C is an indication that quite a good number of them acquired their basic qualification after joining the organisation. This is shown in Table-46C and the trends are shown in Fig-4.6C.

This table shows in Lab-A, 9.9% of the current pool acquired their Bachelors, 13.2% of current pool acquired Masters and 12.9% acquired Ph.D. after joining the organisation. In Lab-B 3.4% acquired Bachelors, 15.3% acquired Masters and 3% acquired Ph.D. after joining the organisation. In Lab-C 1% acquired Bachelors, 10.2% acquired Masters and 2.2% acquired Ph.D. In Lab-D 1.3% acquired Bachelors and 16.4% acquired Ph.D. after joining the organisation.

Thus in all the four labs, it appears, rewards and opportunities for higher academic training were quite active. For acquiring Bachelors and Masters degree , Lab-A was most successful while for acquiring Ph.D. Lab-D was most successful.

iii. Grade & Salary at Different Age

It was noted in section 4.2 that in all the four labs, promotion to higher grade was a two step process. In the first step one attains eligibility by completing a minimum years of service and by showing some level of performance in the current job. In the second step, one's suitability is decided by the promotion committee. Educational qualification is a potential indicator of performance. Thus even through higher qualification as such is not considered in promotion policy, but its effects on promotion rate may be felt through

actual performance . Thus if the higher qualified people do better than the less qualified people, the average grades are likely to be higher for more qualified people. This is shown in Table – 46D.

This table shows the average grades of Bachelors, Masters and Ph.D.s at the age group of 29-31, 39-41 and 49-51. This table shows that in Lab-A in the age groups of 29-31, the average grade is 1.25 for Bachelor and 1.22 for Masters. In Lab-B, the corresponding average grades were 2.0 and 2.4 respectively and that in Lab-C it was 2.7 and 2.9 respectively. In Lab-D, the average grades of Masters in Sciences and Ph.D. were 2.0 and 2.12 respectively. These trends are shown in Fig 4.6D1, Fig-4.6D2 and Fig-4.6D3 for age groups of 29-31, 39-41 and 49-51 respectively. From this trends it appears the difference in the average grades between Bachelors and Masters in the age group of 29-31 were not very high. In other words, in the beginning of career the Masters degree holders do not enjoy any substantial advantage over the Bachelors.

In the age group of 39-41 years, the average grades were 2.33, 3.67 and 3.0 respectively for Bachelors, Masters and Ph.D.'s in Lab-A. The average grade in Lab-B was 3 and 4 for Bachelors and Ph.D.s respectively. In Lab-C, the corresponding average grades were 2.5, 3.2 and 3.5 respectively for Bachelors, Masters and Ph.D. and in Lab-D the corresponding average grades were 3.08 years and 3.17 respectively.

In the age group of 49-51 years, the average grade was 3.51 for Bachelors, 4.06 for Masters and 4.35 for the Ph.D.s in Lab-A. In Lab-B the average grade was 3.6 and 4.3 for Bachelors and Masters respectively. In Lab-C the average grades were 4.04, 5.04 and 4.5 for BE, ME and Ph.D. respectively. In Lab-D, the corresponding average grades were 3.2 and 3.8 for Bachelors and Ph.D.'s respectively. Thus looking at the difference in average grades between Bachelors and Masters, we find this difference were quite small in the beginning career but rose to as much as 1 grade in the age group of 49-51 years. Compared to the difference between Bachelors and Masters, the difference between Ph.D.'s and Bachelors was very significant.

iv. Age Group and Average Salary

Salary is as much important to the organisation as it is to the individual. From the Organisational point of view it is very important because it is major part of the cost of

goods and services delivered by the organisation affecting its market position. From the individual point of view it is a symbol of success.

Table 4.6E shows the average salary of the professionals in different age groups. This table shows that in the age group of 29-31, the average salaries were Rs. 2622 and Rs. 2669 for Bachelors and Masters in Lab-A.. In Lab-B these salaries were Rs. 3338 and Rs. 3260 respectively and in Lab-C these salaries were Rs. 2912 and Rs. 2988 respectively. These trends are shown in Fig-4.6E1, Fig-4.6E2, & Fig-4.6E3 for the age groups of 29-31, 39-41 and 49-51 respectively.

In the age group of 49-51 the average basic salaries of Bachelors, Masters and Ph.D. were Rs. 4702, Rs.5182 and Rs. 5576 respectively in Lab-A. In Lab-B the corresponding average salaries for Bachelors and Masters were Rs. 4986 and Rs. 5487 respectively. In Lab-C, the average salaries of Bachelors, Masters Ph.D. were Rs. 4246, Rs.5931,Rs. 6087 respectively. And in Lab-D the corresponding average salaries were Rs. 5281 and Rs.5377 for Bachelors and Ph.D.

Thus looking at the salary difference between Bachelors, Masters and Ph.D.'s in early career of age of 29-31 and late career of age 49-51, we find. There is insignificant difference between the average salaries of Bachelors and Masters in early career of 30 years of age. Though this difference rises with age. Thus it is not surprising that not many scientists and engineers do go for higher academic qualification even when their laboratories encourage them to do so.

v. Average Age of Reaching Current Grade

Apart from current grade and current salary at different age groups, one could also look at the average age at which the current grade was reached by personnel of different qualifications. The shorter the average age of reaching the current grade, the faster is the promotion rate both current time as well as in the recent past. This is shown in Table-4.6F. These trends are shown in Fig-4.6F1, Fig-4.6F2 and Fig-4.6F3 for Grade-2, Grade-3, and Grade-4 respectively.

This table shows in Lab-A Grade 2 was reached at an average age of 33.2 years by Bachelors compared to 30.1 years by the Masters degree holders. Grade-3 was reached at an average age of 42.8 years by Bachelors, 42.1 years by Masters, and 37.8 years by

Ph.D. and Grade 4 was reached at an average age of 47.4 for Bachelors, 44.7 years and 44.4 years for the Masters and Ph.D. respectively. Thus in all the labs, the average age of reaching higher grades were less for Masters and Ph.D.'s than that of the Bachelors degree holders. In other words, higher qualification does enhance one's promotion potentials.

In Lab-B, the average ages to reach Grade.-2 were 35.3 years and 32.5 years respectively for Bachelors and Masters. In Lab-C, the corresponding ages were 32.9 years and 30.3 years for Bachelors and Masters respectively. In Lab-D, the average ages to reach Grade.2 were 36.7 years for Bachelors degree holders and 32.5 years for Ph.D. degree holders.

vi. Stagnation in Current Grade.

Stagnation is a negative outcome to performance appraisal and recognition system. A high percentage of stagnation for any group will indicate the failure of the performance measurement and recognition system. We have measured stagnation as staying in the same grade for more than 6 years. This is shown in Table 4.6G. The trends are shown in Fig-4.6G1.

This table shows, in Lab-A, when 15% of the BE degree holders were stagnating in the same post for more than 6 years the corresponding percentage for Masters and Ph.D. were 17.8% and 28.4% respectively. In Lab-B there was no stagnation due to recent prompt action. In Lab-C, the stagnation 17.7% for Bachelors, 23.1% for the Masters and 44.4% for the Ph.D.s. In Lab-D the stagnation was 92.1% for Bachelors and 89.5% for Ph.D.s. Thus it appears both in Lab-A and Lab-C, the stagnation pictures are relatively worse for higher qualified professional.

Fig-4.6G2 shows the average tenure in their current grade for differently qualified professionals. Again we find that the higher qualified professionals are staying on the average longer in their present grade than lower qualified ones. Thus it appears though in the past the higher qualified professionals enjoyed some advantage in promotion, but those advantages are possibly disappearing now.

vii. Average Return to Educational Investment in Years Vs Growth due to Labour Market Experience

Though higher qualification leads to faster promotion as was noted in the previous par, but because of highly overlapping pay structure of different grades, the difference in salary between differently qualified professionals are generally not substantial. As a result the average return for educational investment over and above the basic degree are generally found to be very low compared to that is available for acquiring work experience in the organisation. This is shown Table-4.6H. These trends are shown in Fig-4.6H.

This table shows that average rates of return for educational involvement over and above the basic degree in engineering were 3.0% in Lab-A, 0.93% in Lab-B, 0.12% in Lab-C and 0.94% in Lab-D. This has been estimated by estimating the Log of Basic salaries against education investment in years and number of years since Bachelors in Engineering in a human capital model as was shown in table-45.. For the purpose of calculation of education investment in years we have assumed it takes two years for acquire a Master in Engineering, 4 years to acquire a Ph.D. without Masters and 5 years with Masters. In addition, extra qualification of MBA was assumed to take 2 years to complete. The labour market experience was measured by the number of years completed since Bachelor or equivalent degree in Engineering. A human capital model was used to estimate the effect of labour market expenses and educational involvement in years after the basic degree.

From Table-46H it can be seen that the return for labour market experience immediately after graduation is considerably higher than that from an educational investment in higher academic qualification. Thus there is virtually no incentive to go in for higher academic degree beyond the basic degree in engineering. The average growth rate of salary due to labour market experience was 4.03% in Lab-A, 5.84% in Lab-B, 5.14% in Lab-C and 5.11% in Lab-D respectively.

In summary, we find the percentage of professionals who are going for higher academic degrees are quite small. This can be due to un-remunerative career prospects for higher qualified professionals in these labs. The difference in average salary in the first stage of career between professionals with Bachelors, Masters and Ph.D. were too small to compensate for the opportunity cost of acquiring the higher academic degrees. Though in terms of reaching higher grades higher qualified

professionals had an advantage, but in terms actual earning , the difference was not at all attractive. The average rate of return for educational investment above the basic degree was too small compared to the growth rate due to work experience in the organisation. Further, the current trends in stagnation do not indicates particular advantage by the higher qualified professionals.

Table-4.6A

Percentage Distribution of Differently Qualified Professionals

% of Total

Education	Lab-A	Lab-B	Lab-C	Lab-D
Ph.D.	33.4%	5.9%	3.7%	88.2%
ME	33.3%	45.8%	31.8%	
B.E or Eq	33.3%	48.3%	64.5%	11.8%

Table-4.6B

Average Age at which different qualifications were acquired

Average age in Years

Education	Lab-A	Lab-B	Lab-C	Lab-D
BE	23.86	21.8	23.59	22.4
ME	25*	24*	26.1	---
Ph.D.	27**	27**	34.0	32.44

* Assumed value based on the average age of acquiring BE
* Assumed value by adding 4 or 5 years to the average age of acquiring BE

Table-4.6C
Percentage of scientists who acquired different qualifications after joining

Percentages

Education	Lab-A	Lab-B	Lab-C	Lab-D
BE	9.9%	3.4%	1%	1.3%
ME	13.2%	15.3%	10.2%	----
Ph.D.	12.9%	2.95%	2.2%	16.4%

Table-4.6D

Grade Difference due to Different Qualifications:

Average grade

Average Age	Education	Lab-B	Lab-B	Lab-C	Lab-D
29-31	BE or M.Sc	1.25	2.0	2.7	2.0
	M.E. or eq.	1.22	2.4	2.9	-----
	Ph.D.	-----	----	---	2.12
39-41	BE or M.Sc	2.33	3.0	2.5	3.08
	ME or Eq.	3.67		3.2	
	Ph.D.	3.0	4.0	3.5	3.17
49-51	BE or M.Sc	3.51	3.6	4.04	
	M.E or Eq.	4.06	4.3	5.04	
	Ph.D.	4.35		4.5	3.76

Table-4.6E

Average salary of Differently Qualified Professionals at Different Ages

Average Salary in Rs

Average Age	Education	Lab-A	Lab-B	Lab-C	Lab-D
29-31	BE or M.Sc	2622	3238	2912	3000
	M.E. or eq.	2669	3260	2988	----
	Ph.D.	3400	-----	-----	2613
39-41	BE or M.Sc	3700	4013	3650	3200
	ME or Eq.	4500	----	3865	----
	Ph.D.	4165	----	4500	3780
49-51	BE or M.Sc	4702	4986	5246	5281
	M.E or Eq.	5182	5487	5931	----
	Ph.D.	5576	-----	6087	5377

Table-4.6F

Average Age at which Current Grades were reached by Differently Qualified Professionals

Average Age in years

Grade	Edu	Lab-A	Lab-B	Lab-C	Lab-D
2	BE	33.2	35.3	32.9	36.7
	ME	30.1	32.5	30.3	
	PH.D				32.5
3	BE or M.Sc.	42.8	45.9	36.7	38.6
	M.E. or Eq.	42.1	38.5	35.2	----
	Ph.D.	37.8	-------	-------	38.5
4	BE or Eq.	47.4	48.3	42.8	41.1
	ME	44.7	45.5	39.4	------
	Ph.D.	44.4	------	38.1	45.5

Table-4.6G

Stagnation in current grade in terms of Percentage of Total and in terms of average tenure

Education	Measure	Lab-A	Lab-B	Lab-C	Lab-D
BE	Percentage	15%	0	17.7%	92.1%
	Average years in same post	3.59 Yrs	2.2 Yrs	4.9 Yrs	-----
ME	Percentage	17.8%	0	23.1%	---
	Average years in same post	4.1 Yrs	2.4 Yrs	4.9 Yrs	
Ph.D.	Percentage	28.4%	0	44.4%	89.5%
	Average years in same post	4.4 yrs	1.9 Yrs	7.6 Yrs	11.5 Yrs

Table-4.6H

Average return to educational investment over basic degree Vs growth due to labour market experience*

Rate of return

	Lab-A	Lab-B	Lab-C	Lab-D
Educational investment	3.01%	0.93%	0.12%	0.94%
Labour Market	4.03%	5.84%	5.14%	5.11%

* Estimated using least square Method in a Human Capital Framework

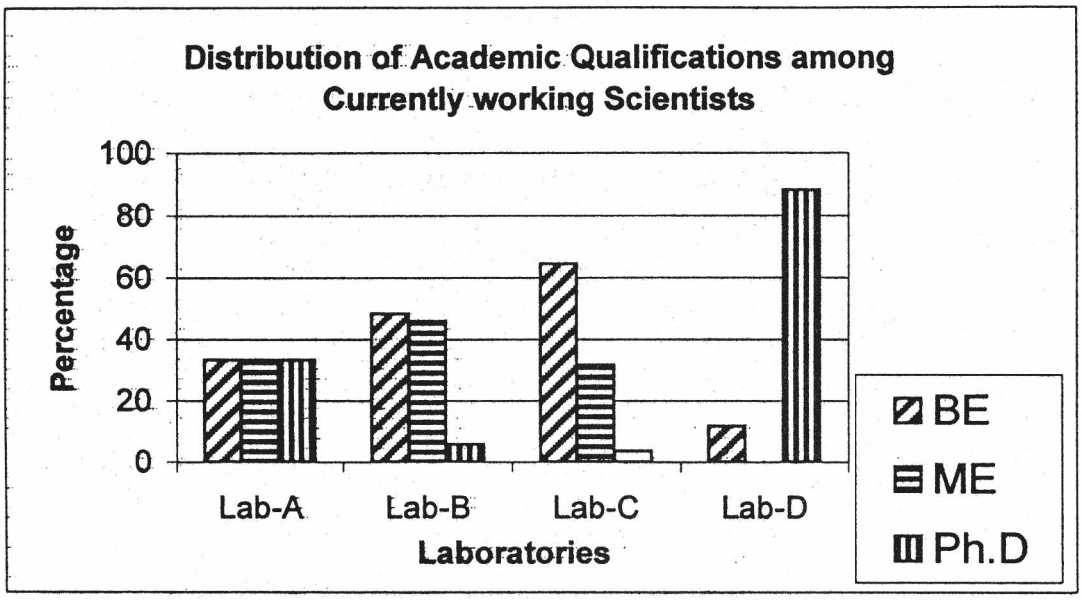


Fig-4.6A

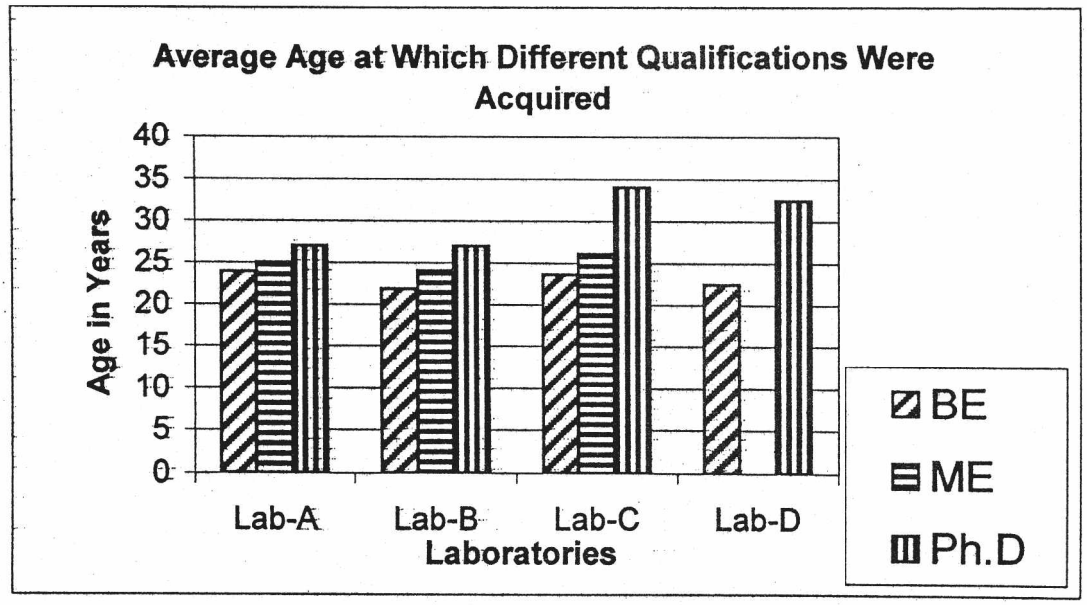


Fig-4.6B

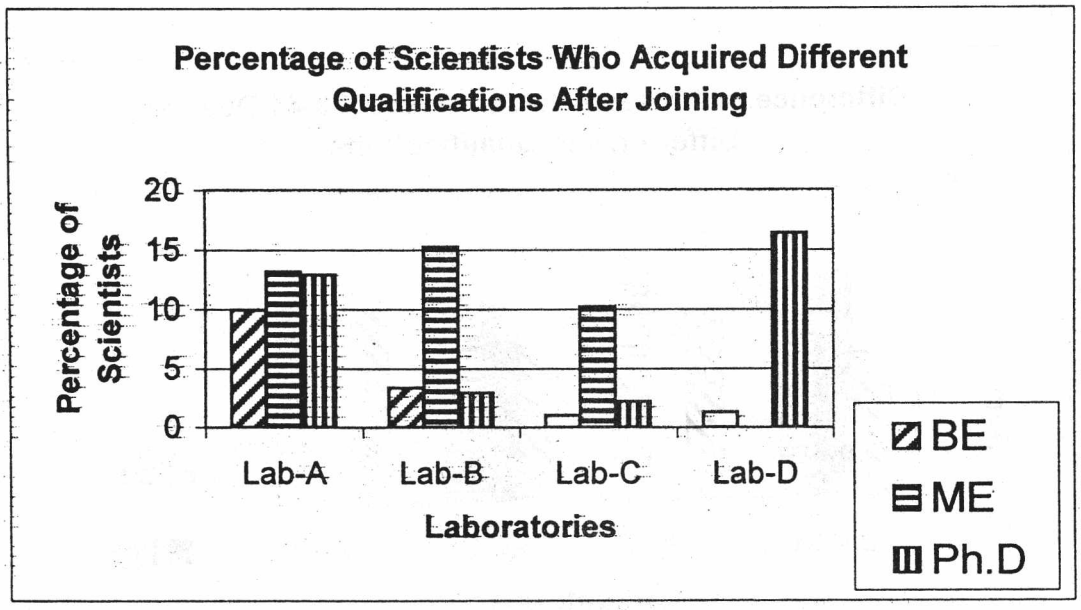


Fig-4.6C

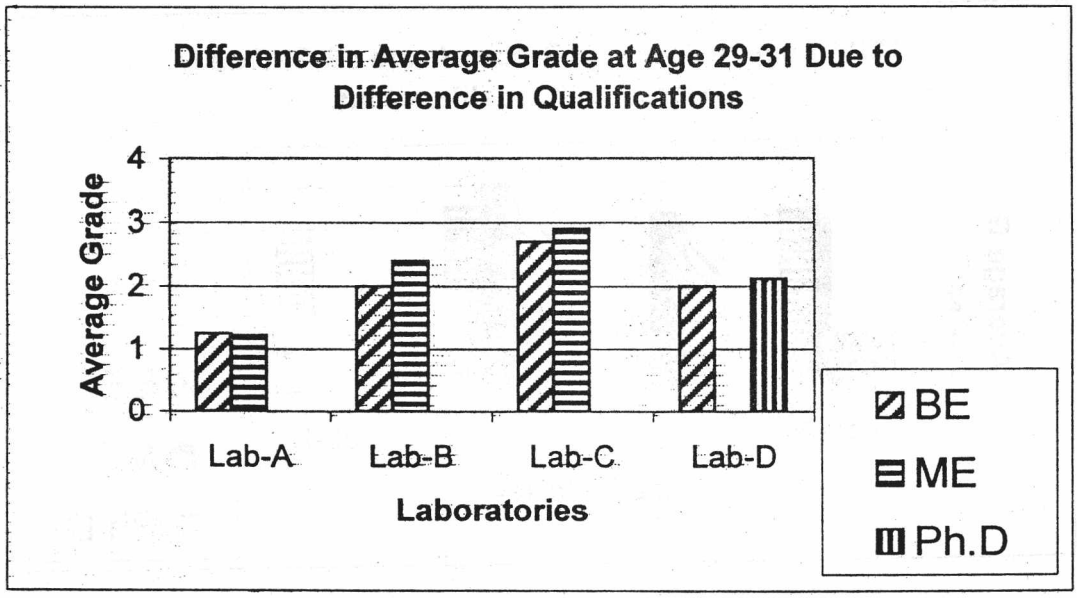


Fig-4.6D1

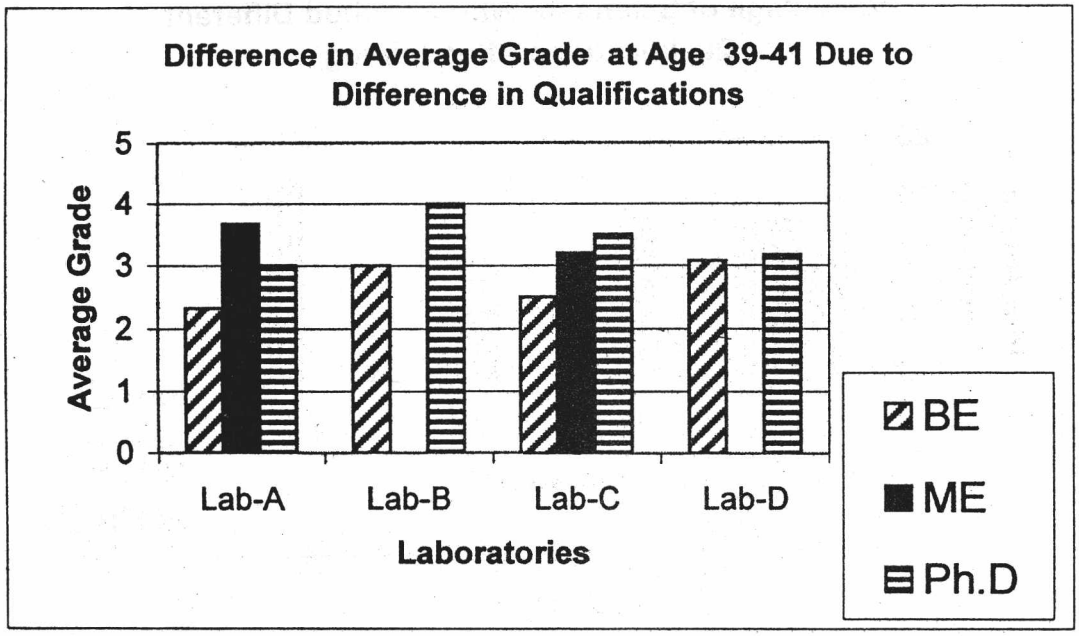


Fig-4.6D2

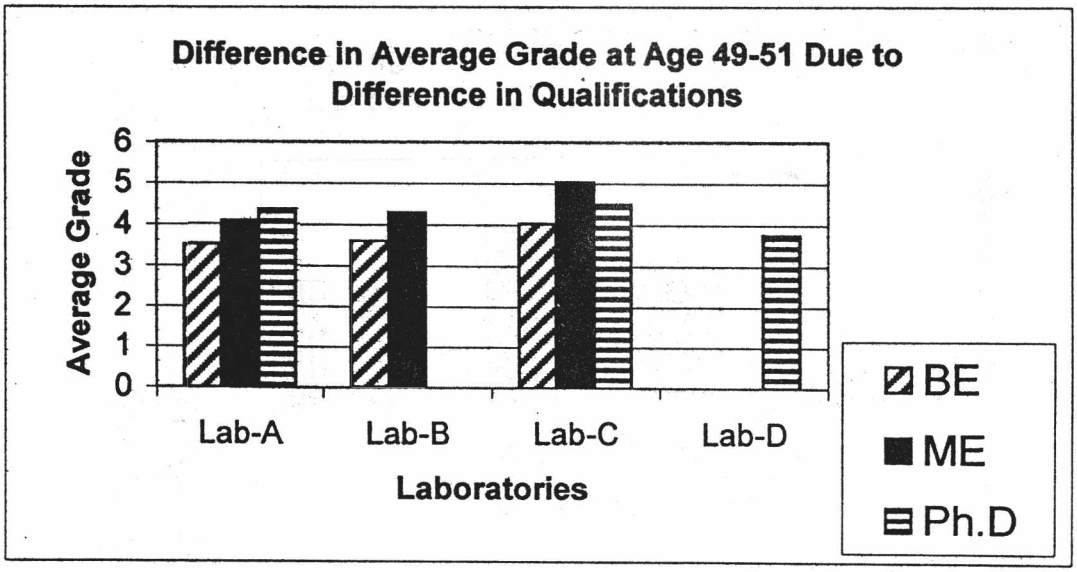


Fig-4.6D3

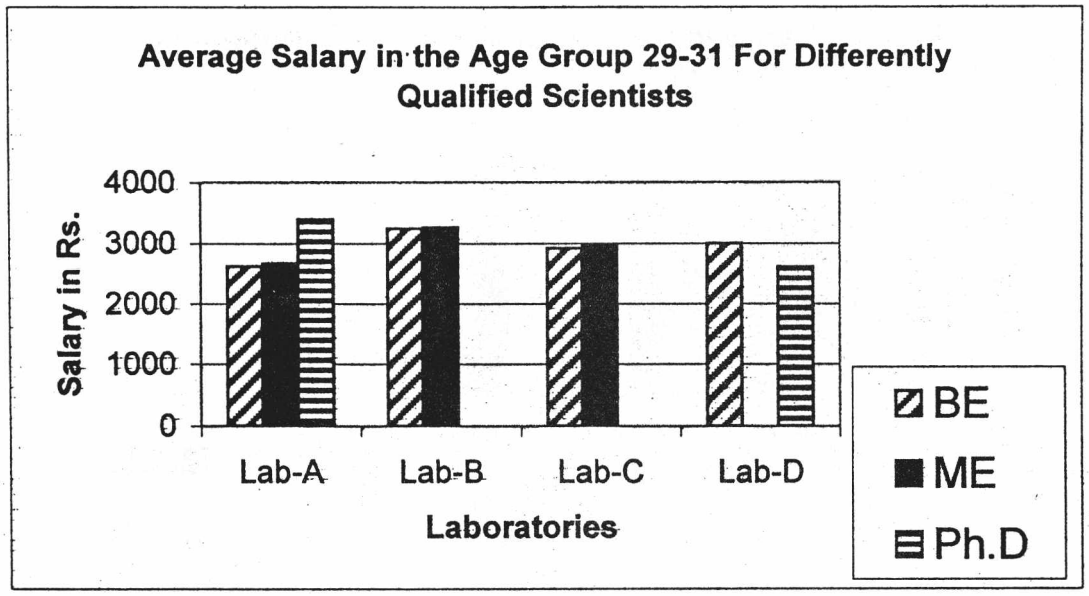


Fig-4.6E1

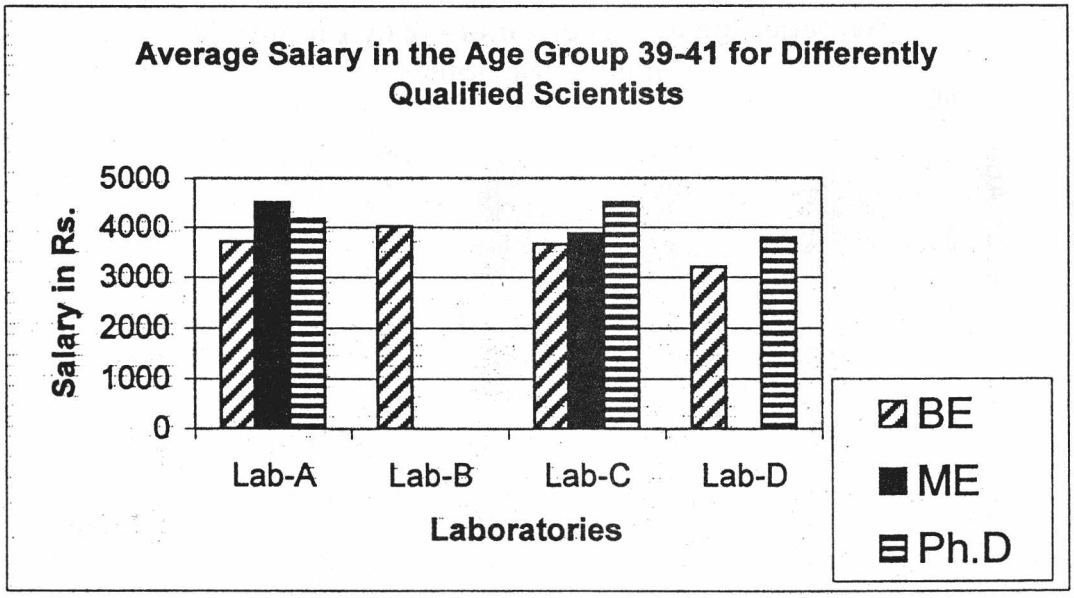


Fig-4.6E2

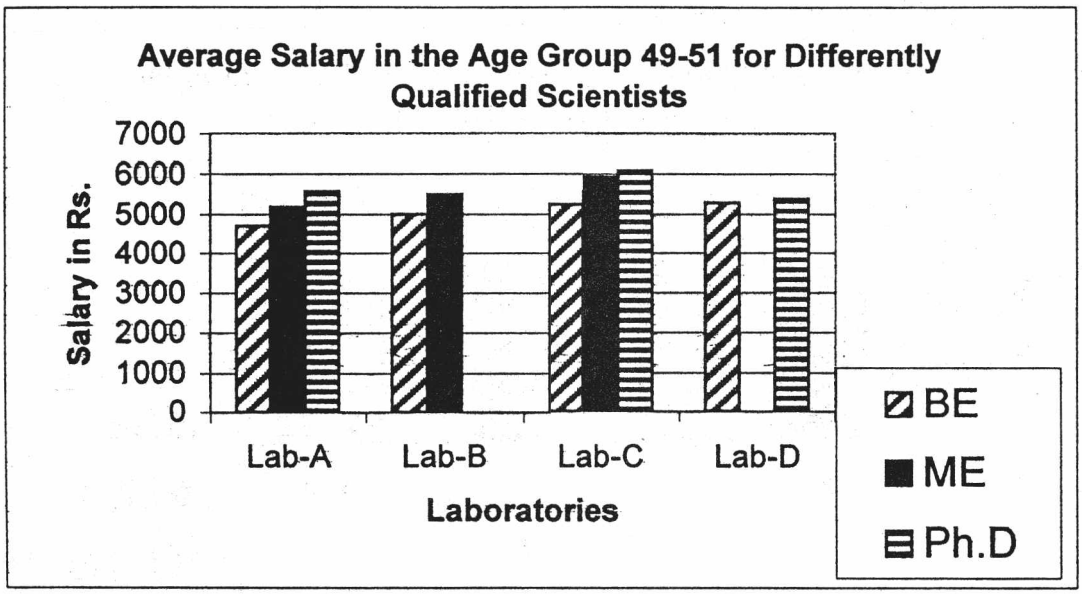


Fig-4.6E3

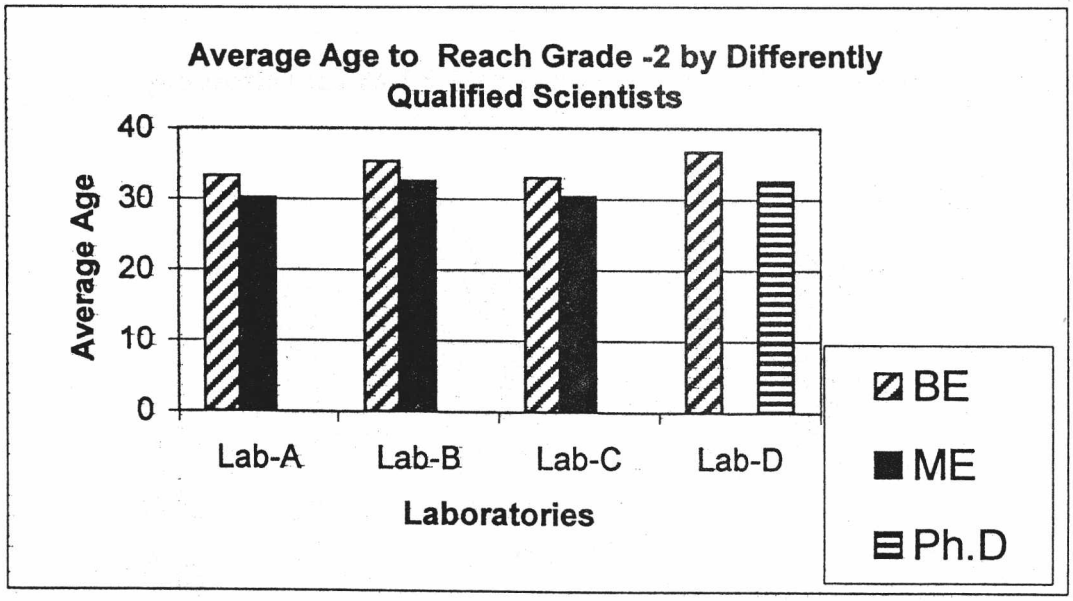


Fig-4.6F1

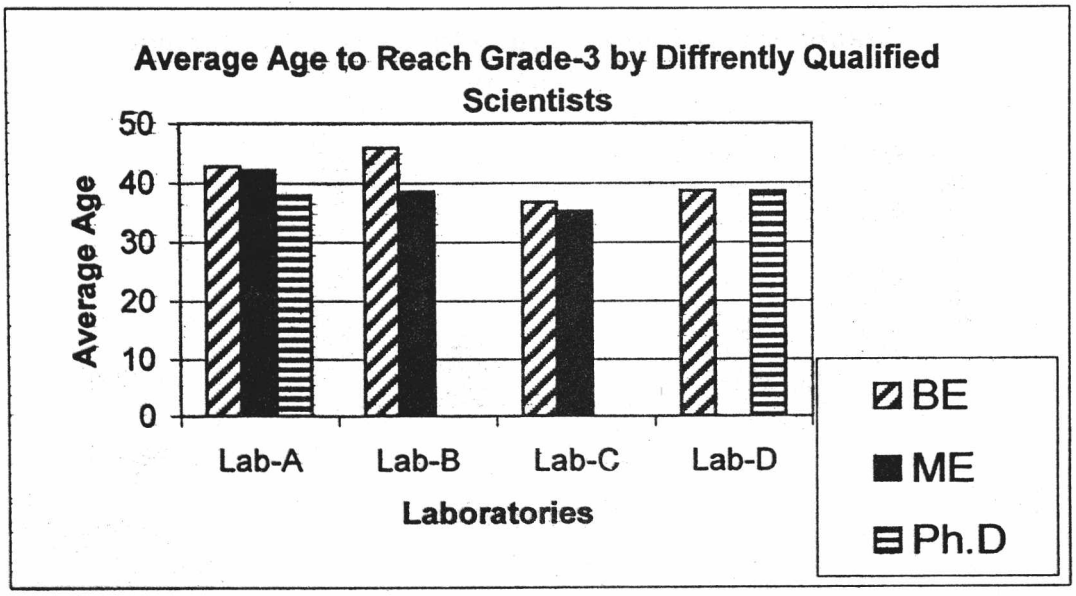


Fig-4.6F2

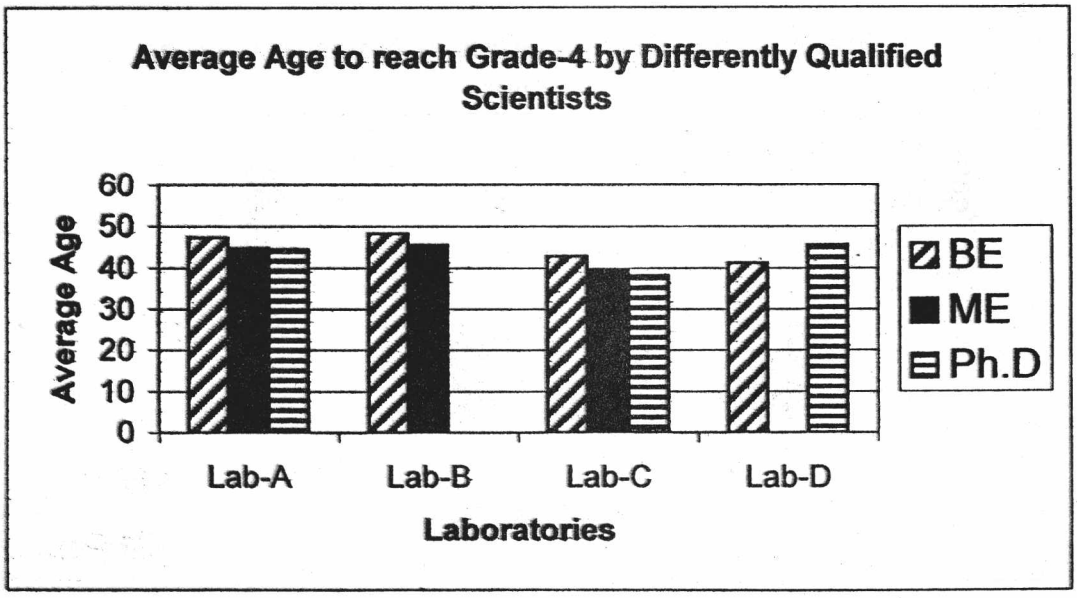


Fig-4.6F3

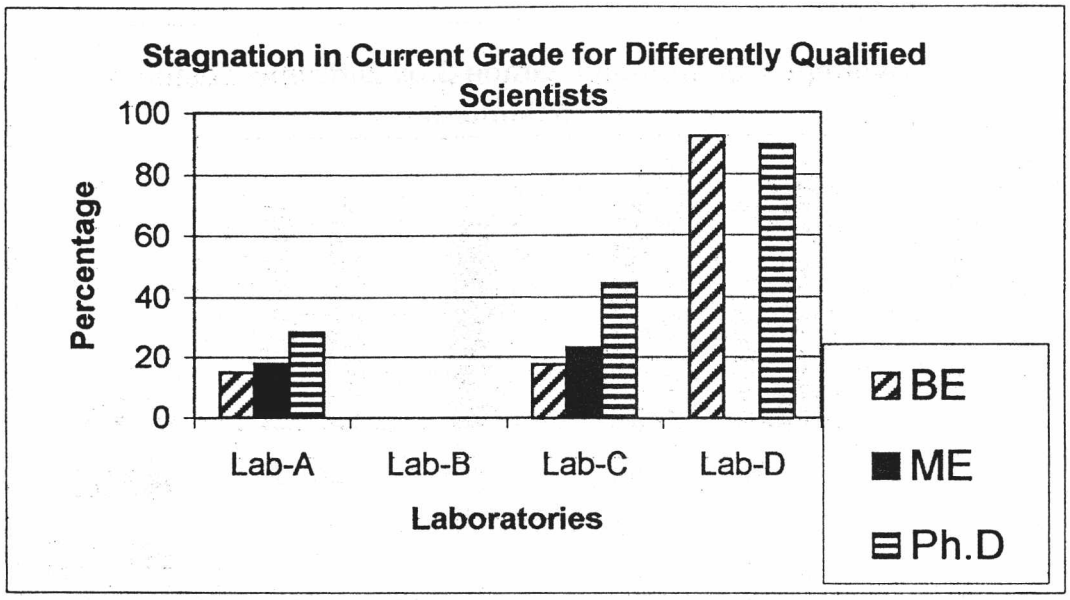


Fig-4.6G1

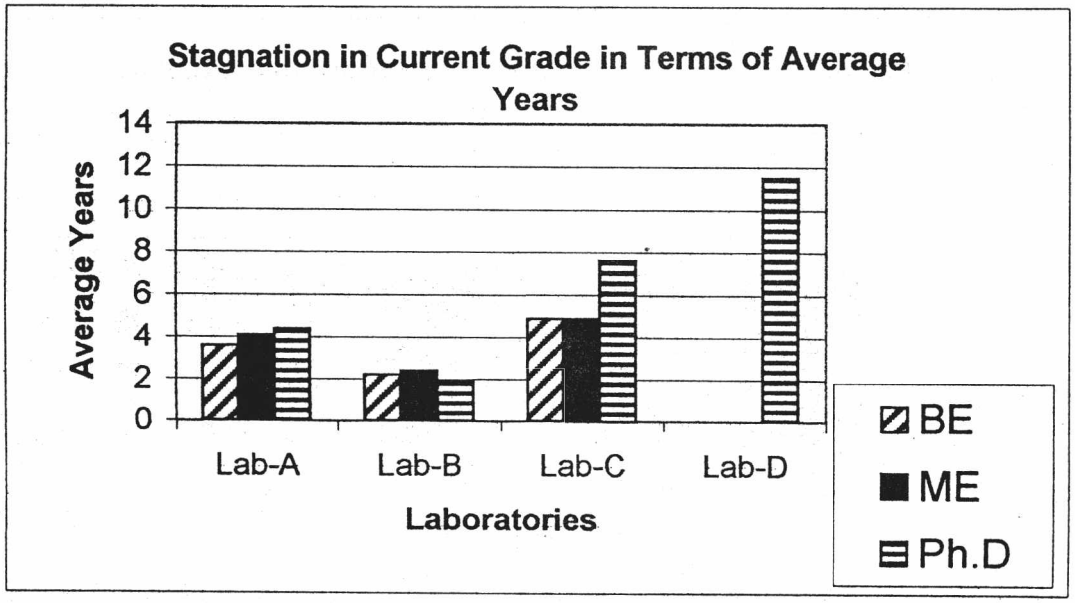


Fig-4.6G2

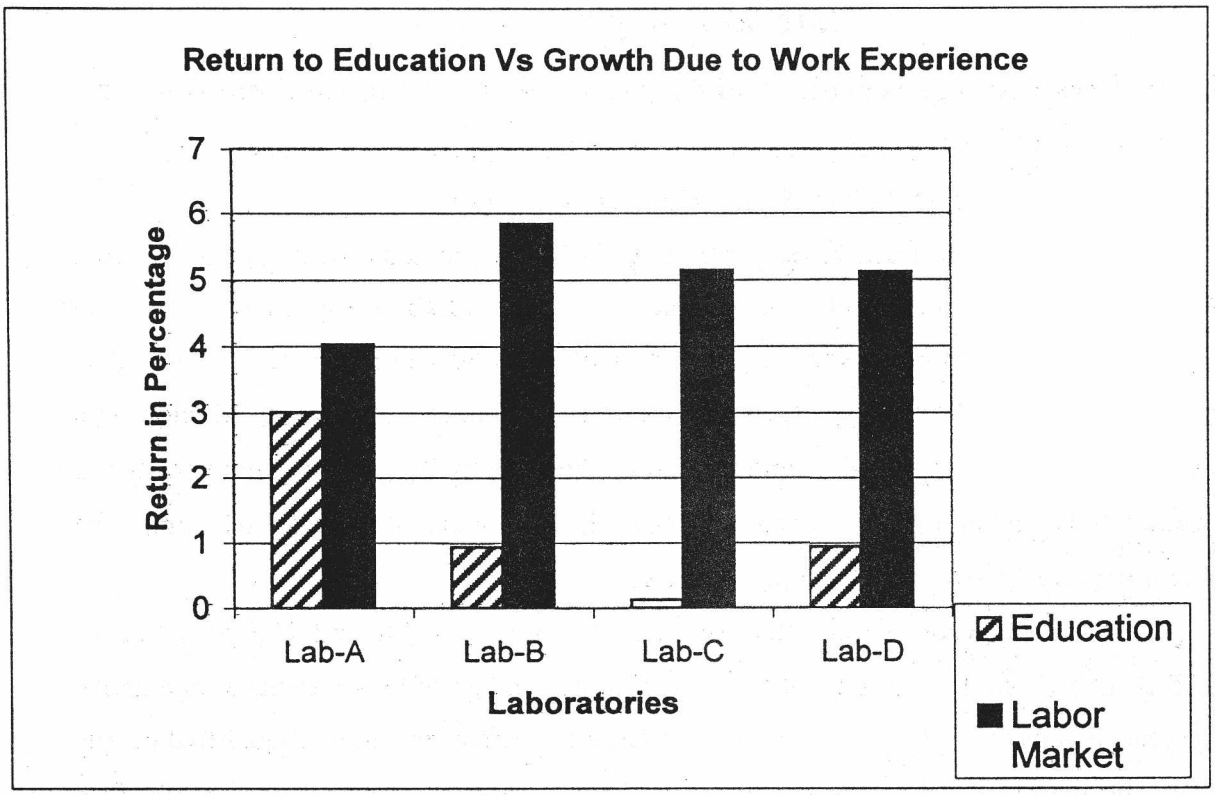

Return to Education Vs Growth Due to Work Experience
Return in Percentage
7
6
5
4
3
2
1
0
Lab-A
Lab-B
Lab-C
Lab-D
Laboratories
Education
Labor Market

Fig-4.6H

Section 4.7: Career Difference between fresh college and lateral Entry recruits

i. Fresh college recruits and experienced recruit in total manpower.

Table 4.7A shows the percentage of fresh college recruits and lateral entry in the existing manpower pool. Fig-4.7A shows the trends in four labs.

The percentage of fresh college recruits without any previous work experience were 44.6% in Lab-A, 60% in Lab B, 56.1% in Lab-C, 39.7% in Lab-D respectively. Thus the percentage of fresh recruits were very very high of about 60% in Lab-B and Lab-C. This means these Labs would be spending quite a substantial amount to develop this manpower to utilise their full potential. Further, because by 25 years it is not possible to acquire very much higher academic degree, it is obvious that these labs must be recruiting mostly lower qualified professionals.

The percentage of lateral entry were 21.8%, 14.3%, 16.1% and 25.8% in Lab-A, Lab-B, Lab-C and Lab-D respectively. A high percentage of new recruits at age above 30 years means the organisation was able to recruit experienced and well-qualified people from the market and because these people were already experienced on the job, they could give valuable service from day-1 in the organisation. A high percentage of older recruits is also an indication of image of the organisation among the professionals. Thus a low percentage of 14.3% of Lab-B and 16.1% of Lab-C indicates possibly these organisations are unable to attract very many experienced and higher qualified professionals from the market. They have to bank very heavily on their in-house training facility. It is also possible that because of the special type of research done by Lab-B and Lab-C for which the market availability of similar jobs is quite low. As a result, even if they try heard they may not succeed in getting enough number of them. This has indeed been the case for Lab-B. During a personal conversation the Director of Lab-B lamented on the difficulties of getting experienced professionals. One of the reasons he cited was that there are not many organisations in the country, which does the kind of work that, they do. Naturally they had to build their entire manpower requirements through their own in-house development process.

ii. Educational Composition of Fresh College Recruit and Lateral Entry Personnel

Education composition of fresh college recruit and lateral entry will indicate to what extent an organisation is able to attract experienced and qualified professionals. A high percentage of Bachelors in the fresh category will indicate that it is getting mostly inexperienced and low qualified personnel. While a high percentage of Masters and Doctorates in this group will indicate that the organisation has good facility for higher academic degrees.

A high percentage of Masters and Ph.D. in the lateral entry category would indicate that the organisation is good in attracting more qualified professionals from academic institutions. On the other hand a high percentage of Bachelors in this croup will indicate that the organisation is able to attract more experienced though less qualified professionals from other organisations.

Table-4.7B shows the percentage distribution of Bachelors, Masters and Ph.D. in the fresh recruit and in the lateral recruit category of four labs. The trends are shown in Fig-4.7B1 & Fig-4.7B2 for fresh and lateral recruits respectively. In Lab-A, the percentage of Bachelors, Masters and Ph.D. in the fresh category are 41.8%, 36.2% and 21.9% respectively. The corresponding percentage in the lateral entry group were 15.9%, 21.7% and 62.3% respectively. Since it is not possible to acquire a Ph.D. by 25 years, so we assume that 21.9% of the Ph.D. in the fresh category were actually in-house Ph.D. In Lateral category they had 62.3% of the total recruits with Ph.D. This meant quite a good percentage of these persons joined the organisation after their Ph.D. and it was because of this that their age of entry was high. A total of only 38% joined with Bachelors or Masters. Thus not many experienced Bachelors or Masters degree holders joined the organisation.

In Lab-B, the percentage of Bachelors, Masters and Ph.D.s in the fresh entry category were 45.7%, 52.4% and 1.9% respectively. A high percentage of Masters in this category indicates that many of them acquired their higher qualification from within the organisation. In Lab-C the percentage of Masters in this group was only 28.4%. This indicates in this lab, not many people who joined with only a Bachelors degree were going for acquiring a Masters degree after joining.

In Lab-D, the percentage of Ph.D. in the fresh recruit category was 84.4%, which meant most of these recruits in this category acquired their Ph.D. after joining.

The education composition of lateral entry in Lab-B was 48% BE, 36% ME and 16% Ph.D. Thus the high age of entry in this organisations was not due to higher academic qualification but due to work experience elsewhere. The picture is similar in Lab-C also. Because in Lab-C as much as 92% joined with either Bachelors or Masters degree. However, in Lab-D as much as 92.5% joined with Ph.D. This means most of the recruits in this category joined after completing their Ph.D.

iii. Average Age to Attain Different Grades for Fresh and Lateral Recruits

From the previous two sections, we can see that we have two categories of personnel in these organisations. One group who joined with lower qualification and acquired higher qualifications after joining and the other group who joined after acquiring higher qualification.

Table-4.7C shows the average age to reach different grade by these two groups. The trends are shown in Fig-4.7C1, Fig-4.7C2, Fig-4.7C3 and Fig-4.7C4 for Lab-A, Lab-B, Lab-C and Lab-D respectively. In Lab-A, the average age to reach Grade-2 was 30.9 years for fresh recruits but 35.4 years by the lateral entry groups. The corresponding average age for Grade-3 were 41.7 years and 40.2 years. Thus except in a few grades the average age was higher for the lateral entry category than the fresh recruit category. As we have seen in previous section, most of the lateral entry were due to acquisition of higher academic qualification, so it is obvious that the career development system encourage people to join the organisations early and then acquire higher qualifications. The picture is same in other three labs also.

In summary, we find lateral entry as a percentage of total number of scientists is moderate in all the four labs. The percentage of lateral entry varies from a low of 14% to a high of 26%. Two labs were quite successful in making their lower qualified professionals acquire Ph.D. after joining. The lateral entry scientist reached different grades at relatively higher ages than those who joined fresh from college.

Table 4.7 A

Fresh entry and lateral entry as Percentage of Total population

Age of entry	Lab-A	Lab-B	Lab-C	Lab-D
Fresh entry or Age of entry< 25 years	44.62%	60%	56.1%	39.7%
Lateral entry or age of entry > 30 years	21.8%	14.3%	16.1%	25.8%

Table 47B
Education composition of two groups

Percentage of total of the group

Group	Education	Lab-A	Lab-B	Lab-C	Lab-D
Fresh	BE	41.8%	45.7%	69.5%	15.6%
	ME	36.2%	52.4%	28.4%	-----
	Ph.D.	21.9%	1.9%	2.2%	84.4%
Lateral	BE	15.9%	48%	73.4%	7.5%
	ME	21.7%	36%	19.0%	-----
	Ph.D.	62.3%	16%	7.6%	92.5%

Table-47C

Average age to attain different grades

Average age in years

Grade	Lab-A		Lab-B		Lab-C		Lab-D	
	Fresh	Lateral	Fresh	Lateral	Fresh	Lateral	Fresh	Lateral
2	30.9	35.4	----	-----	24.7	34.8	37.1	33.6
3	41.7	40.2	33.1	37.1	29.1	42.1	37.1	41.9
4	45.2	47.4	41.3	44.3	34.1	44.6	44.4	45.9
5	47.8	49.2	45.5	47.1	38.4	45.8	----	----
6	53.1	48.2	47.7	45.6	44.4	43.2	----	----

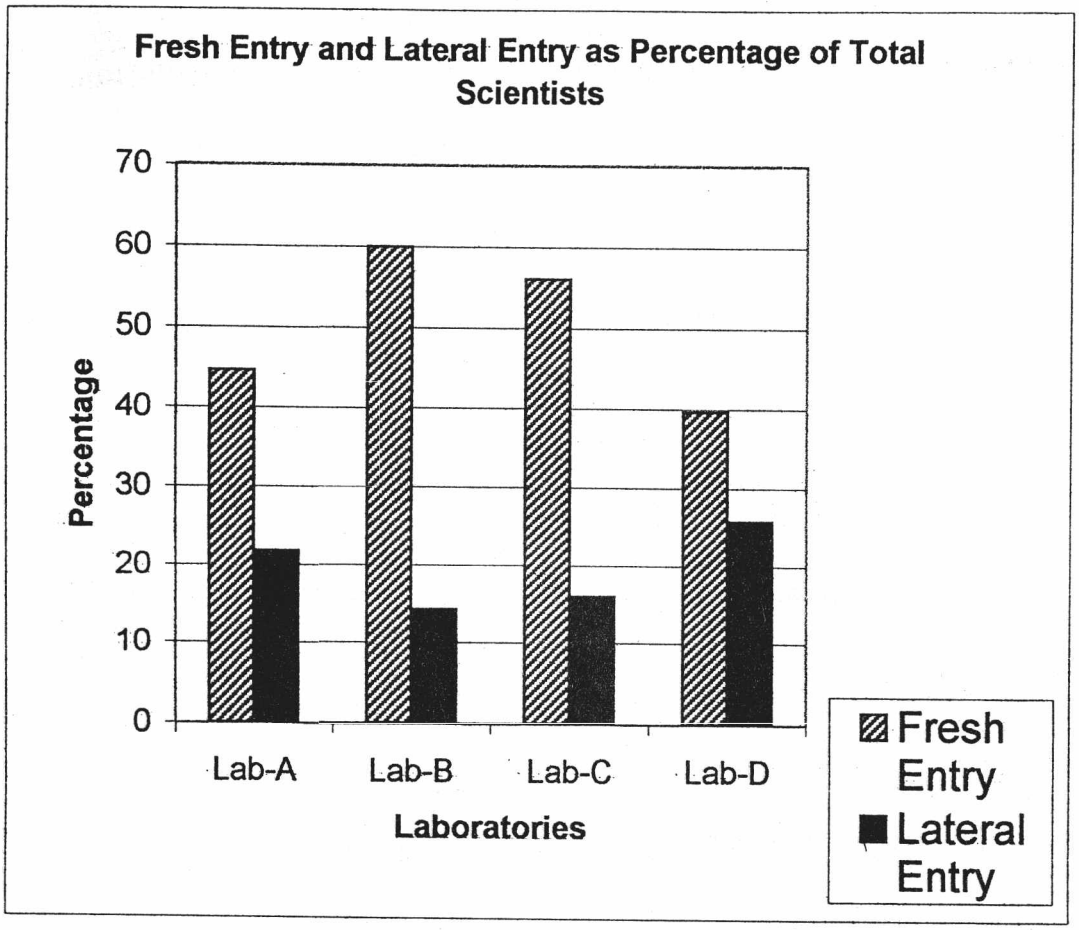

Fresh Entry and Lateral Entry as Percentage of Total Scientists
70
60
50
40
30
20
10
0
Percentage
Lab-A
Lab-B
Lab-C
Lab-D
Laboratories
Fresh Entry
Lateral Entry

Fig-4.7A

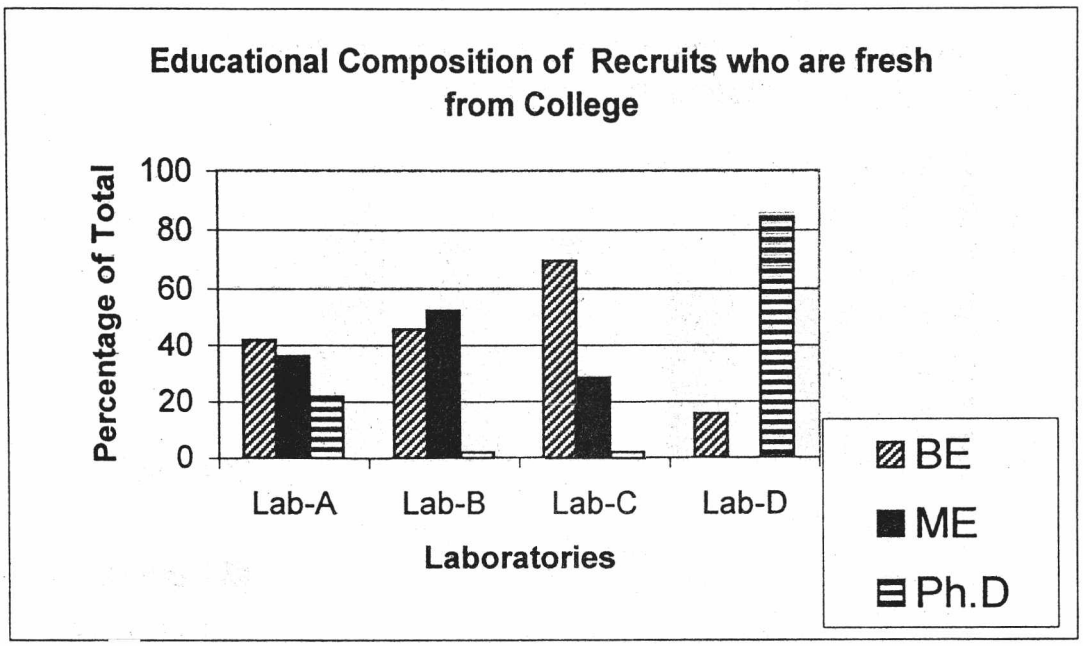


Fig-4.7B1

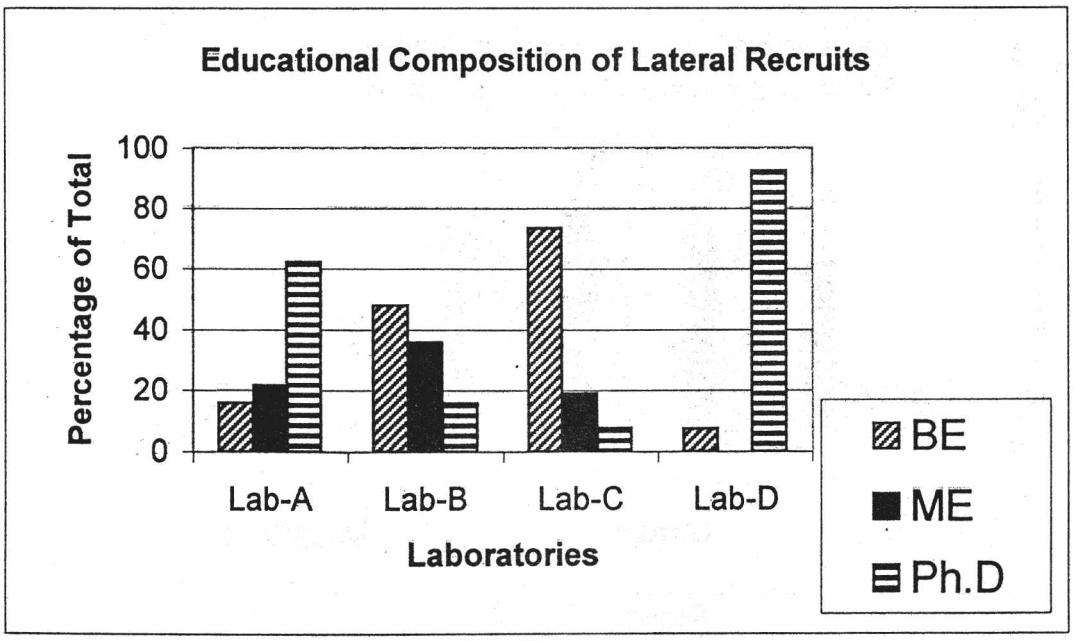


Fig-4.7B2

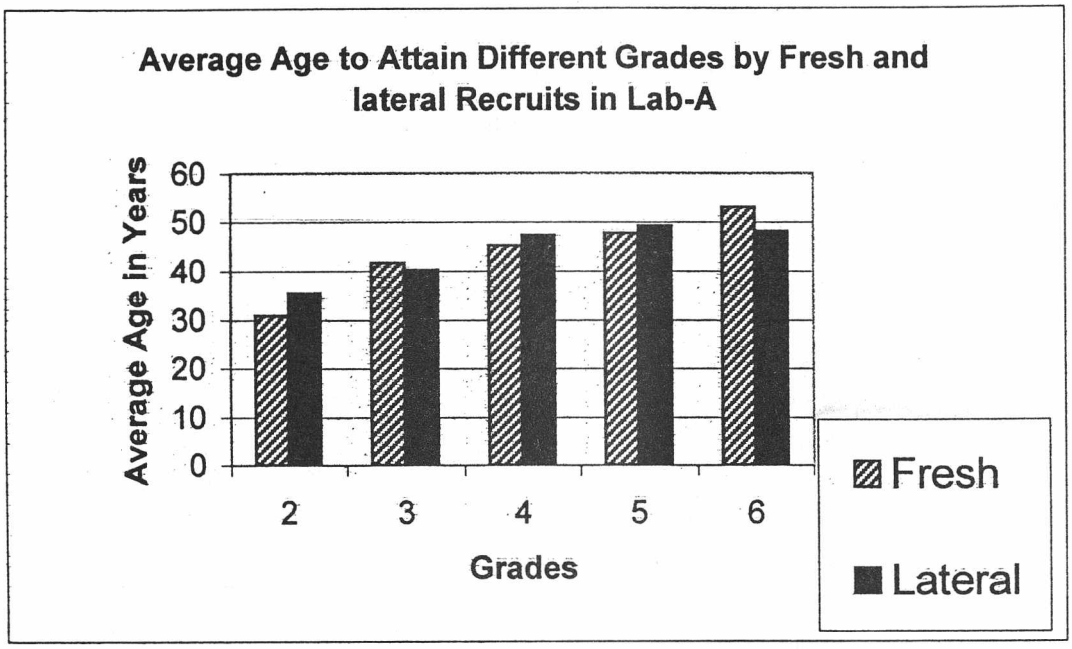


Fig-4.7C1

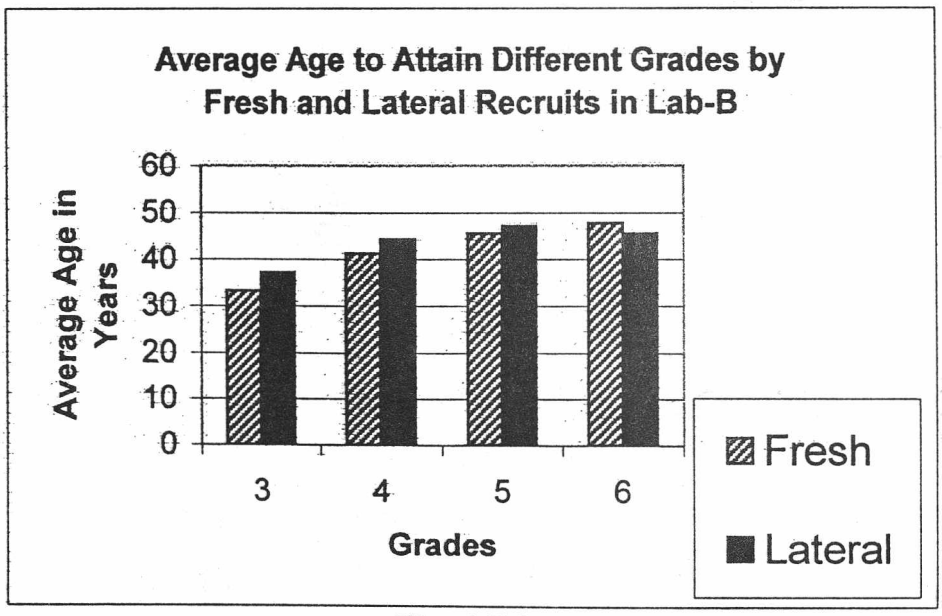


Fig-4.7C2

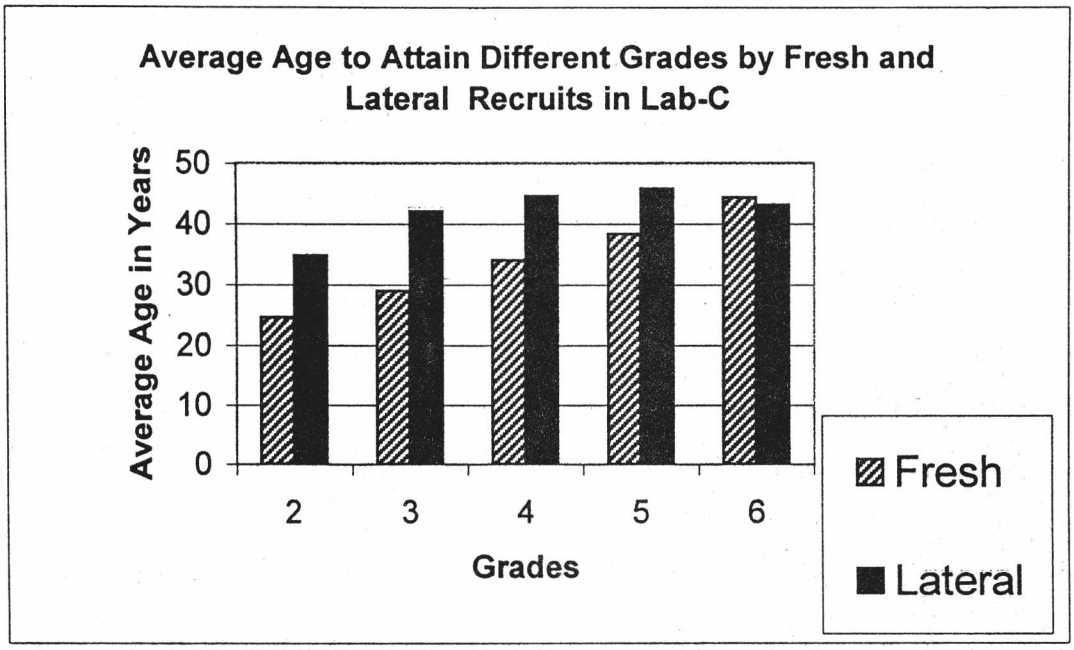


Fig-4.7C3

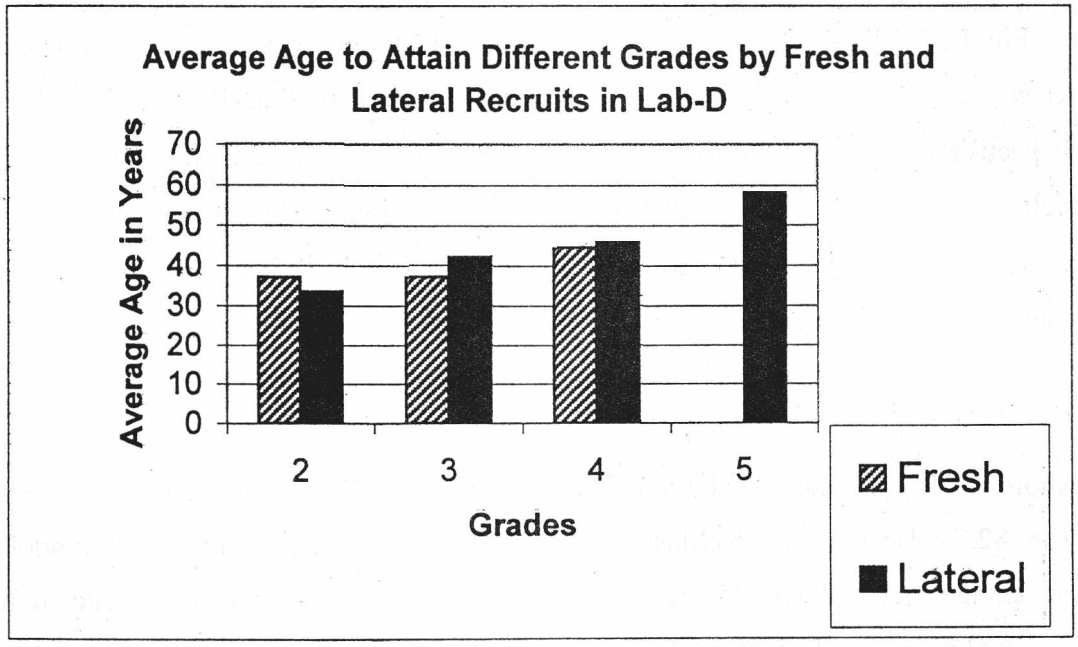


Fig-4.7C4

Section-4.8: Characteristics and Career of Recent Recruits of last five years

i. Recent recruits as percentage of total number of scientists

Fig-4.8A shows the percentages of currently working scientists who joined in the last five years in different labs. Details are shown in Table-4.8A. In Lab-A, 20% of the currently working scientists were recent recruits of last five years. In Lab-B, 11%, in Lab-C 12.6% and in Lab-D 3% of the currently working scientists were the recent recruits of last five years. Thus among the three labs, Lab-A was most successful in recruiting people while Lab-D was least successful to do so. Of course this percentage is the net of all the losses that have taken place during the last five years. The actual rate of recruitment could be higher than this rate when the high rate of turnover of the scientists within a few years of joining were included.

ii. Educational Composition of the Recent Recruits Vs in the Current Pool.

Fig-4.8B1, Fig-4.8B2, Fig-4.8B3 and Fig-4.8B4 show the educational composition of recent recruits and that of the existing pool in Lab-A, Lab-B, Lab-C and Lab-D respectively. Details are shown in Table-4.8B. From this composition we can see how well these labs were able to attract higher qualified professionals from the market or academic institutions. It is obvious that except Lab-D, all other labs failed to recruit more qualified professionals than that they already had. In Lab-A, among the new recruits, there were 49.4% Bachelors, 27.3% Masters and 23.4% Ph.D. degree holder compared to 32% Bachelors, 33.3% Masters and 33.7% Ph.D. degree holder in the current pool as a whole. In Lab-B, the distribution of educational qualification among the new recruits were 82.7% Bachelors, 13% Masters and 4.3% Ph.D.s while that in the current pool these percentage were 48.3%, 45.8% and 5.9% respectively. Thus the percentage of higher qualified people in the new pool was considerably less than what they already had.

In Lab-C, the percentage of Bachelors, Masters and Ph.D.s in the recent recruits were 75.8%, 24.2% and 0% respectively compared to 62.9%, 32.9% and

4.2% respectively in the current pool. Thus in this lab also the difference between the percentage of Masters in the current pool and the new pool was also quite high but was not as high as that in Lab-B. The picture for Lab-D was slightly different. The percentage of Ph.D. and Bachelors were 90% and 10% in the current pool compared to 88% and 12% in the existing pool. Thus in terms of recruiting more higher qualified professionals, Lab-D seemed to be more successful than others.

iii. Average Age of Entry of New recruits

By looking at the average age of entry of new recruits and comparing that with the age of entry of currently working manpower, we can see whether the organisation is attracting more experienced or more fresh persons with no work experience. Assuming that most people who joined this govt. organisation were very good as students and have had no spell of unemployment, a higher average age of entry would be an indicator that it was attracting more experienced people than before.

Table-4.8C showed the average age of entry of new recruits and the average age of entry of the current pool. The trends are shown in Fig-4.8C1, Fig-4.8C2, Fig-4.8C3 and Fig-4.8C4 for Lab-A, Lab-B, Lab-C and Lab-D respectively. This table showed the average age of entry of current scientists in Lab-A was 27.4 years while that of the new recruits was 29.1 years. In Lab-B, the average age of entry of current scientists was 25.6 years while those of the new recruits were 27.7 years. In Lab-C, the average age of entry of current scientists were 26.1 years while that of the new recruits was 27.5 years. In Lab-D, the average age of entry of current scientists was 27.3 years while those of the new recruits were 28.1 years. Thus in all the four labs, the average age of entry of the new recruits was higher than that of the existing scientists. Considering that, except in Lab-D the percentage of higher qualified people in the recent recruits were less than the corresponding percentage in the current pool, this increase age of entry could be explained by the recruitment of more higher qualified people. The only other possibility was that, there were more percentage of experienced people among the new recruits than before.

Table-4.8C also shows the average age of entry of differently qualified personnel in the current pool and in the new recruits groups. In Lab-A, the average ages of entry of the recent recruits were 27.3 years, 26.4 years and 35.9 years for Bachelors, Masters and

Ph.D.s respectively compared to 26.1 years, 26.3 years and 29.7 for Bachelors, Masters and Ph.D.s respectively in the existing pool. Thus even when we look at the average age of entry by splitting the population by educational qualification, we find the new recruits in all the qualification class joined at a higher average age than before.

Thus on the whole, it appears all the four labs are able to attract more experienced personnel than before.

iv. Impact of Education and Outside Work Experience on The Starting Grade

Most of the new recruits who joined with outside work experience have only a few years of such experience. Naturally, in most organisations, these experienced recruits inspite of their prior experience started career only at the entry grade. Unless one joins the organisation with sufficiently good number of years of such experience, the starting grade is unlikely to be anything other than the entry grade applicable to fresh recruits. In most organisations such recruits were few. As a result the data on those who joined above the entry grade were very scanty. Only in Lab-A and Lab-C, we could get a small sample of new recruits who joined with sufficiently long work experience in some other organisation and joined in grades above the entry grade. Table-4.8D shows the average age at which this experienced people joined the organisation at grades above the entry grade. By comparing this age of entry with the average age of entry of reaching the grade we can see how the outside work experience was treated at the time of hiring of these experienced professionals.

In Lab-A, 8 professionals with Bachelors degree joined in Grade-2 at an average age of 33.6 years. 5 persons with Masters degree joined in Grade-2 at an average age of 33.8 years. 28 persons with Ph.D. joined at an average age of 32 years. In Section 4.6, we have seen that in Lab-A, the average age of reaching Grade-2 was 33.2 years for Bachelors and 30.1 years for Masters. Thus in Lab-A, professionals who joined with outside work experience seemed to have had no advantage over others at the time of joining. Rather, it delayed their entry into higher grade.

In Lab-A, 4 persons with Ph.D. joined in Grade-3 at an average age of 36.6 years. The corresponding average age of reaching this grade by the currently working scientists was 37.8 years. 3 Persons with Ph.D. joined in Grade-4 at an average age of 43.8 years.

The corresponding average age of reaching this grade was 44.4 years. Thus it appears those joining with outside work experience seems to have some advantage over the existing working people when they joined at sufficiently long work experience from outside.

In Lab-C, 2 professionals with Masters degree joined in Grade-2 with an average age of 31.5 years. The corresponding average age for promotion is 30.3 years for Masters degree holders. Thus in this organisation, people coming from outside seem to suffer from a disadvantage as far as climbing the ladder goes.

As for the advantage of higher qualification at the time of joining, we find in Lab-A, the possession of higher qualification seems to have some advantage when one has a Ph.D. The average age of joining Grade-2 for Ph.D. degree holder was 32 years compared to 33.6 years of the Bachelors and 33.8 years of the Masters degree holders.

v. Impact of Educational Qualification and Outside Work Experience on The Starting Salary

At the time of joining different organisation treat outside experience differently. Some have very clear policy about how many increments and what grade one should get for how many years of work experience and of what type of experience. While some have no written policy but use considerable discretion at the time of giving job offer. Thus by looking at the importance of education and outside experience on the starting pay and comparing that with the currently working scientists we can see how outside work experience and higher academic qualifications are treated at the time of job offer for professionals who join with work experience in some other organisations.

Due to absence of starting salary data of lateral entry recruits in most organisations, this could not be done in all the organisation. We had a small sample of 42 scientists in Lab-C for whom we had data on the starting pay. This data has been used to estimate the impact of educational qualification, outside work experience and outside experience type on the starting salary at the time of joining. This is shown in Table-4.8E. Table -48E shows the OLS estimate of starting pay of new recruits of last 5 years who joined with work experience and compared that with the OLS estimate of current salary of those who joined fresh from college without any work experience. The outside experiences were divided into three groups with one group for experience in Govt.

organisations, one group for experience in public sector organisations and one group for experience in private sector organisations.

From Equation (1) of this table it can be seen that average joining pay of Masters degree holders was Rs145 more than those who joined with only a Bachelors. The average joining salary of Ph.D. degree holders was Rs897/- more than those who joined with only a Bachelors degree. Compared to the effect of education, the effect of outside work experience was quite small. For every year of such experience the average joining pay went up by Rs34.8/- only. The influence of the type of work seems to be quite insignificant. It is to be noted that as much as 90% of the variations of the starting pay is predictable based on educational qualification and work experience alone.

Education (2) shows the estimation of the current salary of those who joined fresh from college. This equation shows that as much as 87% of the variations can be explained by these two variables. The current salary of Masters degree holders was Rs139/- more than of the Bachelors. The Ph.D. degree holder earns about Rs650/- more than the Bachelors degree holders. Thus the influence of higher education on current salary of fresh college recruits seemed to be less than a corresponding effect on the starting salary of professionals who joined with outside work experience. **Thus it pays to change a job when one has a higher qualification.** Of course this is only in one organisation.

The current salary goes up by about Rs142/- for every years of work experience in the organisation. This is quite high in comparison to only Rs35/- for those who joins with outside work experience.

Thus while changing job, it is better to join a Government R & D lab at the earliest opportunity.

In summary, in three out of four labs, recent recruits of last five years have lower percentage of higher qualified professionals than what they have now in their organisation. The average ages of entry of the recent recruits are higher than those who joined before indicating that more experienced professionals are joining now. The advantage of outside work experienced in terms of getting to higher grade seems to accrue only when one joins with a Ph.D. and with considerable experience. Advantage of higher qualification on salary is high when such qualification is combined with mobility experience.

Table-4.8A

Recent Recruits of last five years as % of total

Lab-A	Lab-B	Lab-C	Lab-D
20%	11%	12.6%	3%

Table- 4.8B

Educational Characteristics of the recent recruits

Percentages of total

Education level	Lab-A		Lab-B		Lab-C		Lab-D	
	Existing	New	Existing	New	Existing	New	Existing	New
BE or Eq.	26%	49.4%	11%	82.7%	62.9%	75.8%	12%	10%
ME or Eq.	33.3%	27.3%	50%	13%	32.9%	24.2%	----	------
Ph.D.	33.7%	23.4%	6.1%	4.3%	4.2%	0%	88%	90%

Table-4.8C

Average age of entry of new recruits and existing manpower pool for different education class

Average age of entry

Education level	Lab-A		Lab-B		Lab-C		Lab-D	
	Existing	New	Existing	New	Existing	New	Existing	New
All	27.4	29.1	25.6	27.7	26.1	27.5	27.3	28.1
BE or Eq.	26.1	27.3	25.3	28.4	26.2	28.1	26.2	23.2
ME or Eq.	26.3	26.4	25.5	27.7	25.7	26.9		
Ph.D.	29.7	35.9	27.4	38.3	28.2	----	27.4	28.4

Table-4.8D

Impact of education and work experience on the starting grade of recent recruits who joined above the entry grade.

Average age

Grade Joined	Education	Lab-A #	Lab-A Ave. age	Lab-B	Lab-C #	Lab-C Ave. age	Lab-D
2	BE or eq.	8	33.6	----	-----		----
	ME	5	33.8	----	2	31.5	-----
	Ph.D.	28	32.0	----	----		
3	Ph.D.	4	36.6				
4	Ph.D.	3	43.8				

Table-4.8E

Estimation of impact of outside experience on the starting salary (Lab-C only)

	Dependent Variables	
Independent Variable	Those who joined above the entry grade **Joining Pay**	Those who joined fresh from college **Current Salary**
Intercept	1958	2241.4
Ed1	145.3 (5.37)	138.9 (2.51)
Ed2	897.3 (15.92)	650.5 (3.31)
Outside Experience	33.86 (4.65)	------
Experience Type	7.34 (0.53)	------
Organisational Experience	--------	142.1 (39.8)
R^2	0.90	0.87
n	42	275

( ) T- Statistics

Experience Type = 1 if Govt. organisation
= 2 if public sector undertakings
= 3 if private sector undertakings

Ed1 = 1 for Masters degree holders
= 0 Otherwise

Ed2 = 1 for Ph.D. degree holders
= 0 Otherwise

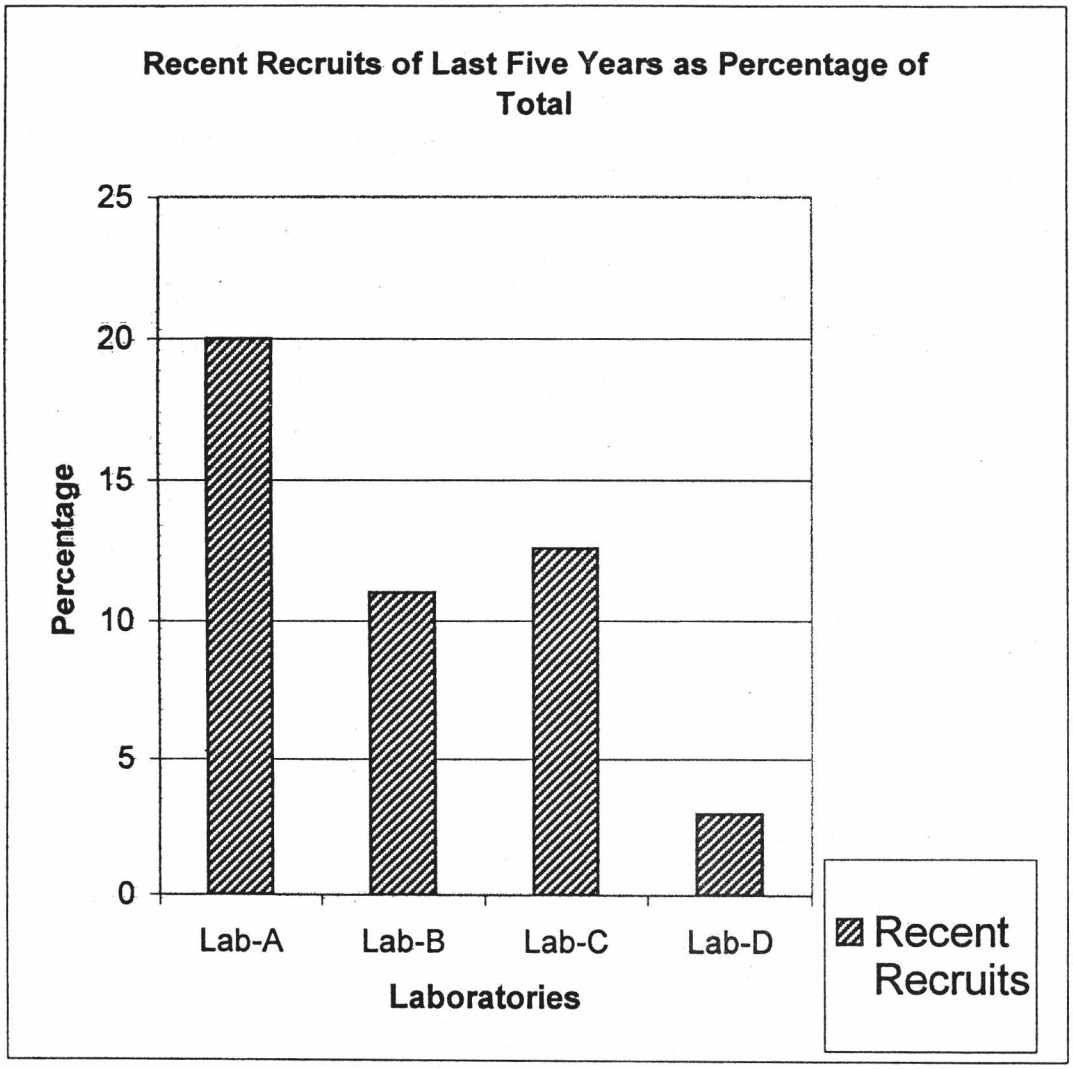

Recent Recruits of Last Five Years as Percentage of Total
25
20
15
10
5
0
Percentage
Lab-A
Lab-B
Lab-C
Lab-D
Laboratories
Recent Recruits

Fig-4.8A

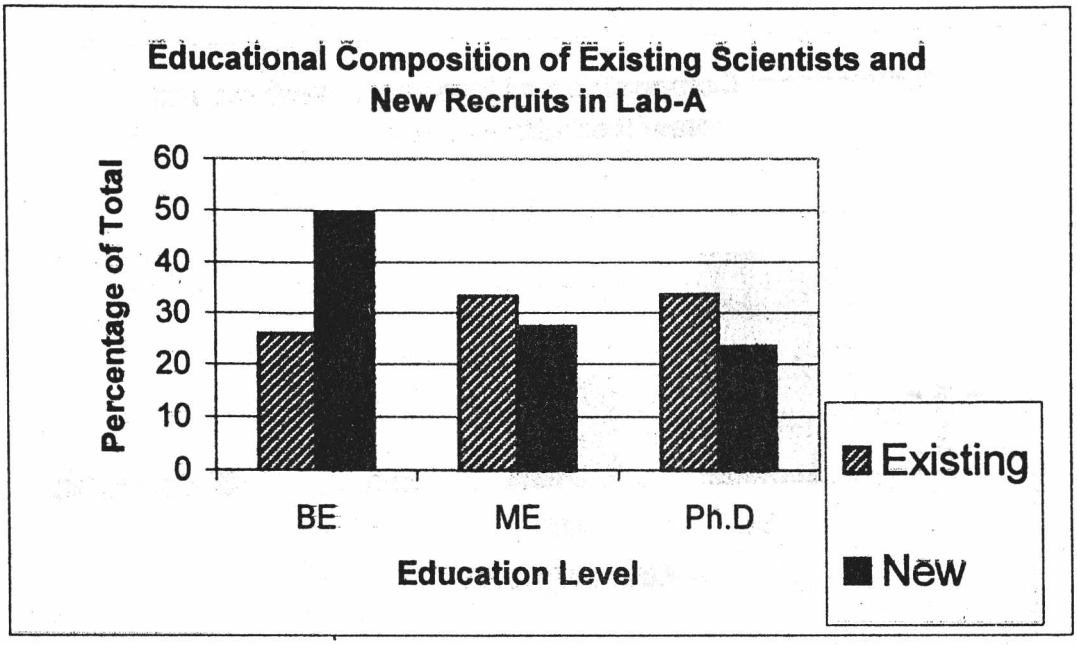


Fig-4.8B1

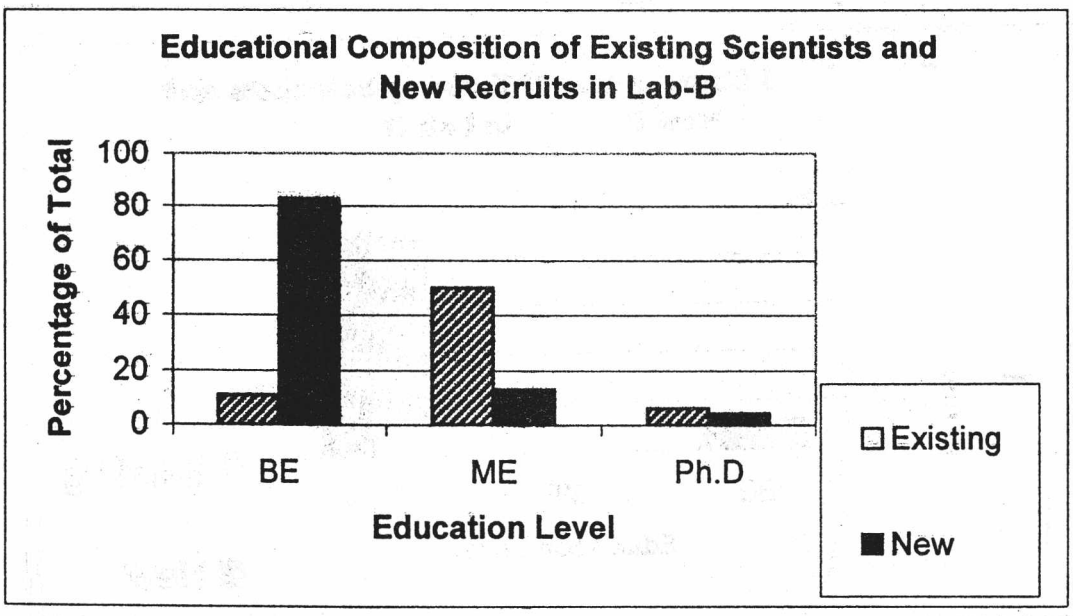


Fig-4.8B2

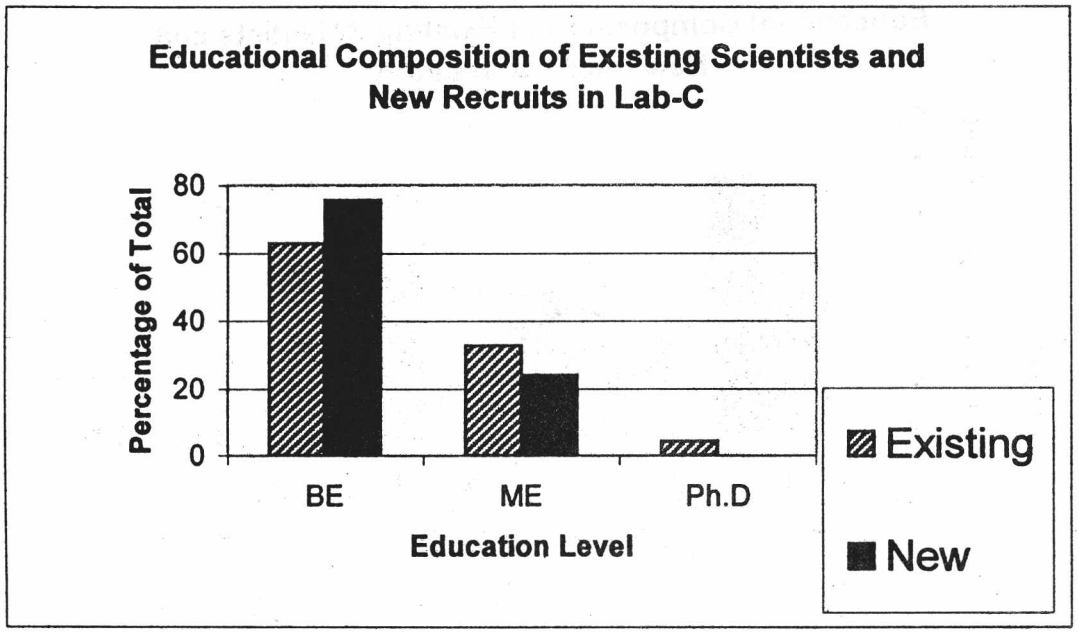


Fig-4.8B3

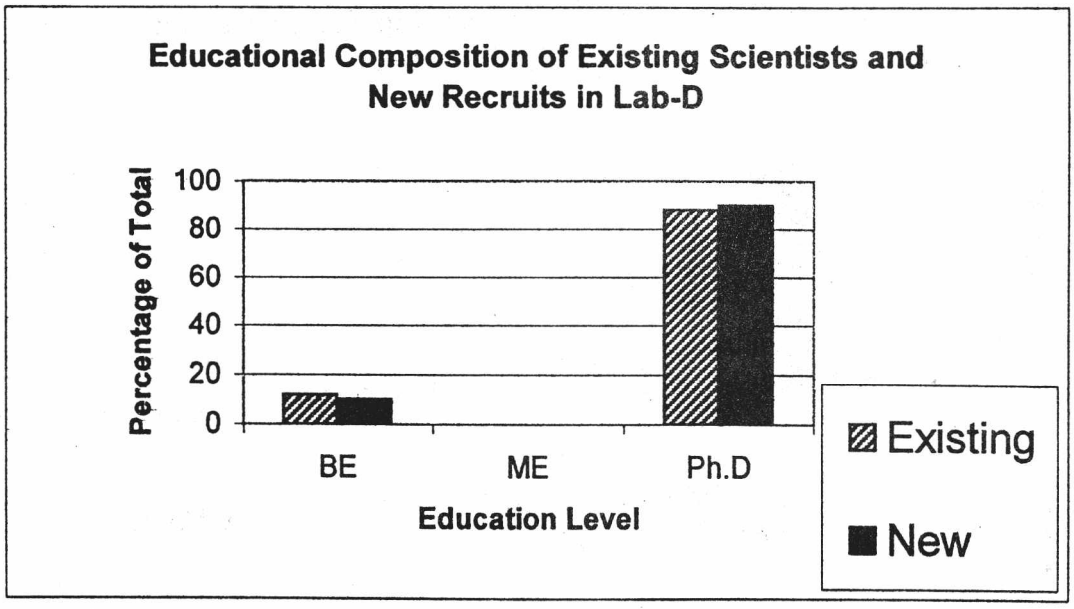


Fig-4.8B4

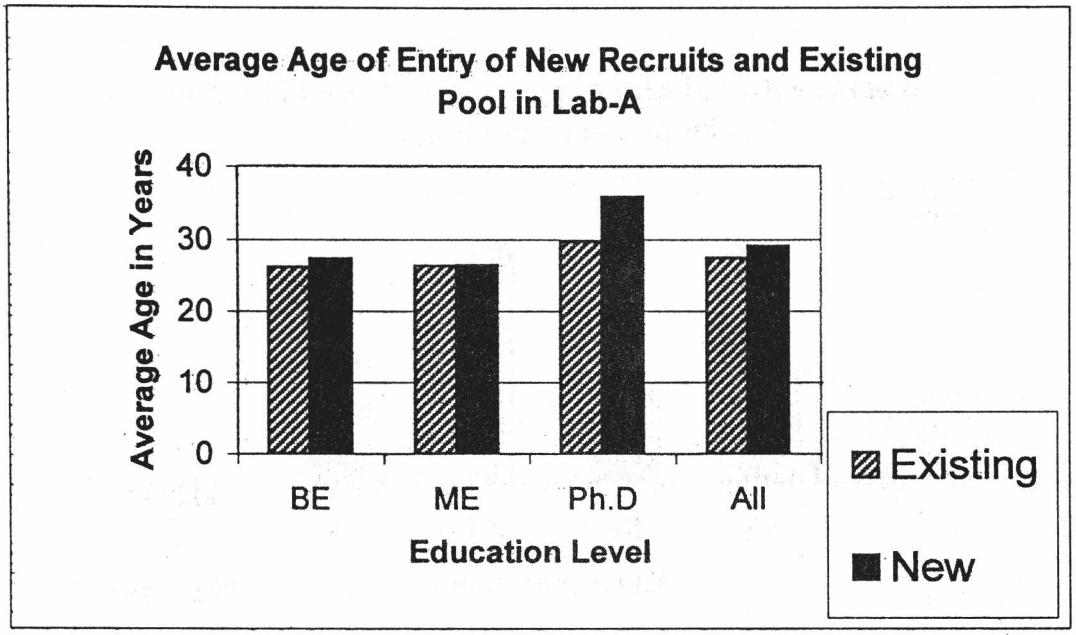


Fig-4.8C1

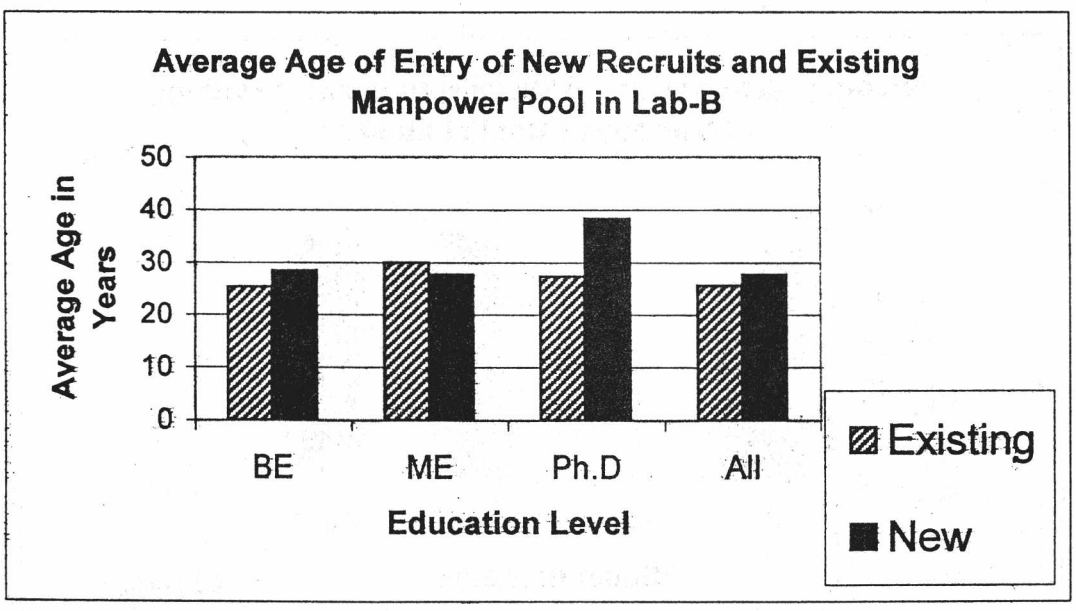


Fig-4.8C2

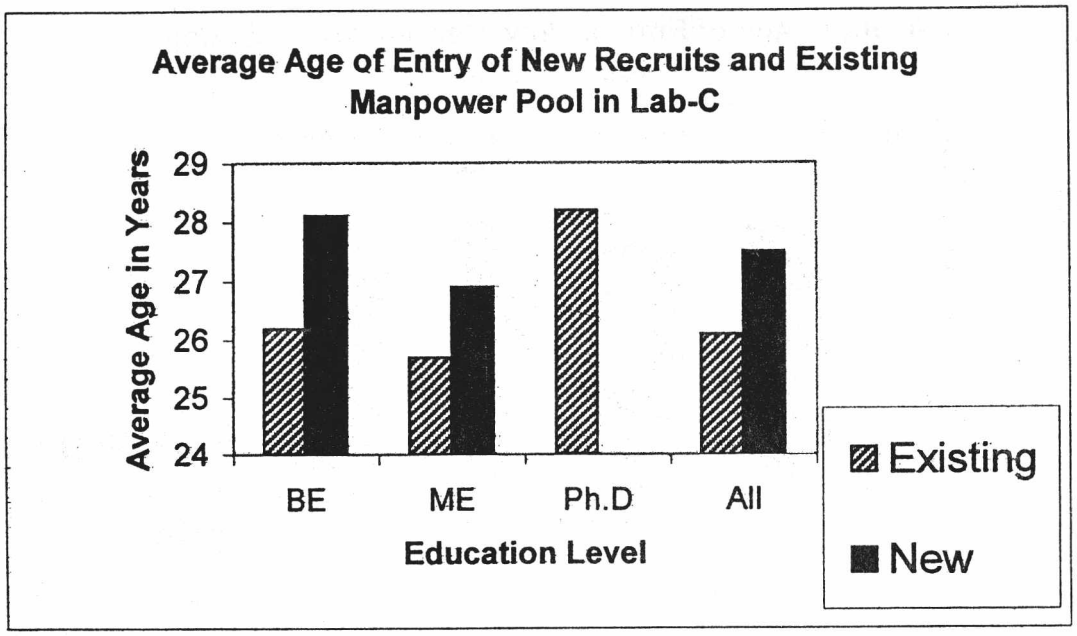


Fig-4.8C3

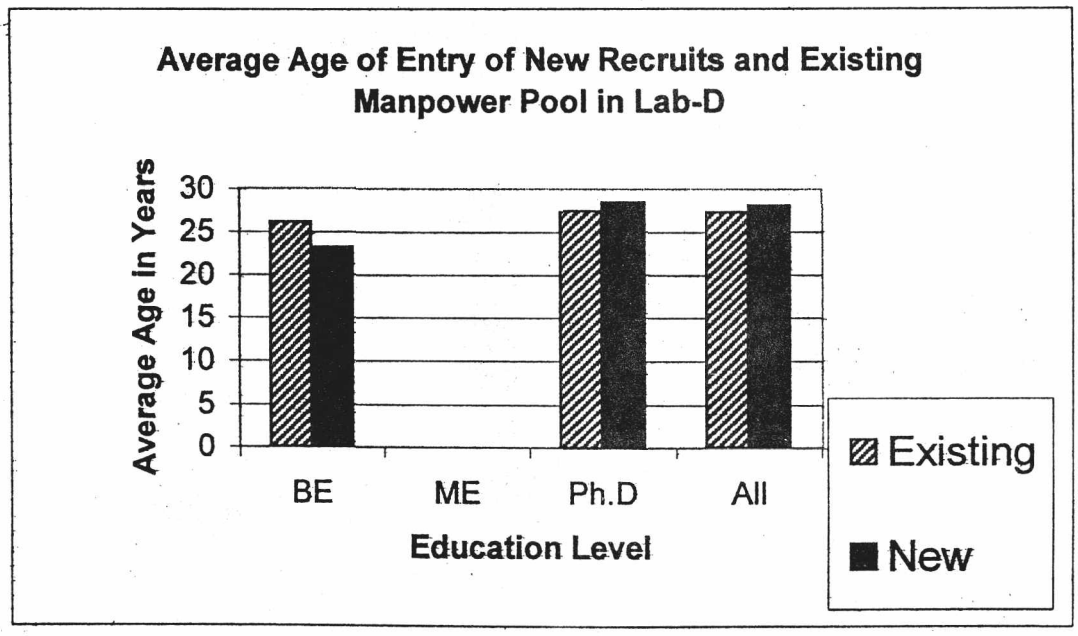


Fig-4.8C4

Section 4.9: Distribution of Promotion time, Fast Track and Stagnation

i. Promotion Time and Evidence of Fast Track

Table-4.9A shows the shortest possible time to reach different grades starting from a particular grade, if the organisation has explicit policy to identify superior performer and recognise their performance by promoting them to higher grades at the shortest possible time. This fast track career growth could be by way of promotion or by direct recruitment through open competition. This Table shows that starting in Grade-1, the shortest possible time to reach Grade-2 is 3 years in Lab-A, 3 years in Lab-B and less than 4 years in Lab-C. There is no fast track promotion or recruitment in Grade-2 in Lab-D. Lab-C promotion policy does not specify any requirement for fast track promotion but their normal promotion time is 4 years. So any promotion at 3 years or less can be considered as fast track promotion. Later we would see, that in Lab-C there were occasions when promotion did take place even in 2 years of service in the grade.

Starting at Grade-1, the shortest possible time to reach Grade-3 is 6 years in Lab-A, 6 years in Lab-B, 6 years and less in Lab-C and 5 years in Lab-D. In Lab-D, promotion policy does not have any policy to promote a person to Grade-3 in 5 years but the direct recruitment policy permit a competent scientist to get to Grade-3 after acquiring a minimum of 5 years of service in Grade-1.

If one starts in Grade-2, then the shortest possible time to reach Grade-3 is 3 years in Lab-A, 3 years in Lab-B, 3 years and less in Lab-C. For Lab-D, Grade-2 is not a valid grade for promotion as such there is no policy statement on promotion from this grade. The shortest time to reach Grade-4 from Grade-2 is 6 years in lab-A, 6 years in Lab-B and 6 years and less in Lab-C.

Because of small data set, and very many missing promotion data in the intermediate years, tracking the career of fairly large sample over a period of time was difficult. Thus identifying fast track performers by this method was a bit difficult. Instead we took an indirect method whereby we took the initial grade of a group of persons in a particular year, and then looked at their present grade and the time they took to cover the

gap between the initial grade and the present grade. This time distribution was then compared with the minimum time required under the fast track scheme as given in Table-49A. The people who satisfied these criteria were counted as fast track performers.

Table-4.9B show the distribution of promotion time for scientists who started career in a particular year and are now in a higher grade in 1997. In Lab-A a total of 44 persons started career in Grade-1 in 1981, out of which 28 are now in Grade-4 and 16 are in Grade-3. Those who are in Grade-4 took a minimum of 11 years and a maximum of 15 years to reach this grade. Since the fast track time to cover this grade distance as given in Table-49A is 9 years, so we find there is no person in the fast track. Though there could be one or two instances when a person got his/her promotion in the shorted possible time of 3 years. Similarly, those who are in Grade-3 took a minimum of 10 years and a maximum of 15 years. Since the fast track time for two promotions is 6 years, so again we do not find any person in that career track. Thus among the scientists who started career in 1981 with their starting grade as the entry grade for scientist, we do not find any evidence of fast track.

We had another fairly good sample of scientists whose years of joining was 1983 and whose starting grade was Grade-1. 20 scientists started career in Grade-1 in 1983. In 1997, out of them 7 are in Grade-4, 12 are in Grade-3 and 1 is in Grade-2. The minimum and maximum time taken to reach Grade-4 was 12 and 13 years respectively with a mean of 12.5 years. So again we find no fast track scientists from the 1983 cohorts. The minimum and maximum time taken by the Grade-3 scientists of 1983 cohorts is 8 years and 11.5 years respectively with no person in fast track career.

We find in 1984, a total of 22 persons started career in Grade-1, of which 18 are in Grade-3 now. The minimum and maximum time taken by them to reach this grade were 8 year and 12 years. Since the fast track time to cover two promotions is 6 years, so there was no person in the fast track from the 1981 cohort. In 1985, 11 persons started career in Grade-2 of which 10 are in Grade-4 now. The time taken by them were minimum 8 years and maximum 13 years with no person in the fast track. In 1992, 12 persons started career in Grade-1. All the 12 are in Grade-2 now. The time taken by them were minimum 3 years and maximum 5 years with 2 persons i.e. 17% getting the promotion in 3 years. Because it is only one promotion, so strictly speaking we cannot

say that there was fast track movers among the 1992 cohorts. But looking at their promotion records, we can say that there is potential fast track movers in this batch. Only by looking at the promotion record of 1998 we can check this possibility.

In Lab-C, the table shows in 1987, 25 persons started career in Grade-1 of which 21 are now in Grade-4. Out of this, 14 reached this grade in 9 years or less . Since the fast track time to cover 3 grades is 9 years in this lab, we find as many as 56% are in the fast track. Similarly in 1990, 47 persons started career in Grade-1 of which 46 are now in Grade-2. 20 out of 46 got the promotion in less than 4 years which is the normal time for promotion. Thus among the 1990 cohorts there are 42.5% potential fast track scientists which can be confirmed only after the next round of promotion.

Lab-D data for promotion was very sketchy. Though the present grade and the date of joining were available but it was not impossible to track their starting grade or any other grade before their current grade. Based on their date of starting career in the organisation and the date of reaching the current grade, we could estimate only the total time elapsed to reach their current grade. This has been done for Grade-3 and Grade-4.

At present there were 311 persons in Grade-3 of which 19 reached this grade in 5 years or less time since their joining the organisation. Considering that 5 years of minimum service was required to appear for direct recruitment in this grade, we can say that about 6.1% of the currently working scientists are fast trackers in this organisation. There were a total of 140 scientists in Grade-4 now. Out of this 13 reached this grade at time less than 10 years since their joining the organisation. Thus about 9.3% of the currently working scientist can be considered as fast tracker.

ii. Incidence of Stagnation

We have defined stagnation as missing the promotion two times in a row. Since the normal promotion time was 5 years for both Lab-A and Lab-B, we have assumed more than 6 years in the same grade signify missing promotion two times in a row. The normal promotion time in Lab-C is 4 years, thus working more than 5 years in the same grade would signify stagnation according to our definition. However, to have a meaningful comparison on the level of stagnation with Lab-A and Lab-B we have assumed 6 years as the time of date for stagnation in Lab-C also. The same logic was also used to measure stagnation in Lab-D. Though there was no provision for direct promotion

in Lab-D above Grade-2. The incidence of stagnation as measured according to the above criteria are given in Table-49C and the trends are shown in Fig-4.9C.

From this table it can be seen that that the average level of stagnation in Lab-A and Lab-C was about 20%. The level of stagnation was as much as 90% in Lab-D. The level of stagnation was nil in Lab-B. It is possible that they have cleared all of their outstanding cases lately.

About the variation of stagnation by grade, it can be seen that stagnation rises at the higher level and is quite small at lower grades. In Lab-A, the stagnation is quite high in Grade-3 and Grade-4. In Lab-D, the stagnation is highest in Grade-3. On the whole, we find the level of stagnation is quite high in most organisations.

In summary, we find in a few labs there were evidence of fast track career in the sense that two or more promotions in a row was achieved at the shortest possible time. Along with evidence of fast track career there were quite a high percentage of professional who missed their normal promotion two times in a row.

Table-4.9A

Promotion policy and the shortest possible time to reach a grade

Starting grade	Present grade	Number of years of experience required			
		Lab-A Years	Lab-B Years	Lab-C years	Lab-D years
1	2	3	3	<3	----
	3	6	6	<6	5
	4	9	9	<9	10
2	3	3	3	<3	----
	4	6	6	<6	----
	5	9	9	<9	----

Table-4.9B

Actual promotion time for different grade intervals in different organisations

Lab	Cohort year	Starting Grade	Number	Current grade	Number	Min	Max	No. in fast Track	% in fast track
Lab-A	1981	1	44	4	28	11	15	0	0
				3	16	10	15	0	0
	1983	1	20	4	7	12	13	0	0
				3	12	8	11.5	0	0
				2	1				
Lab-B	1984	1	22	3	18	8	12	0	0
		2	8	4	8	9	13	0	0
	1985	2	11	4	10	8	13	0	0
	1992	1	12	2	12	3	5	3	17%
Lab-C	1987	1	25	4	21	7	11	14	56%
	1990	1	47	2	46	2	6	20	42.5%
	1992	1	25	2	23	4	6	0	0
Lab-D				3	311	0	12+	17	6%
				4	140	0	16+	12	9%

Table- 4.9C

Incidence of Stagnation(More than 6 years in same grade)

Percentage of total

Grades	Lab-A	Lab-B	Lab-C	Lab-D
ALL	20%	0	20%	89.8%
1	10.4%		1.9%	70.2%
2	10.8%		10.8%	73.3%
3	25.9%		11.8%	95.9%
4	15.9%		45.8%	88.9%
5	34.5%		32.8%	

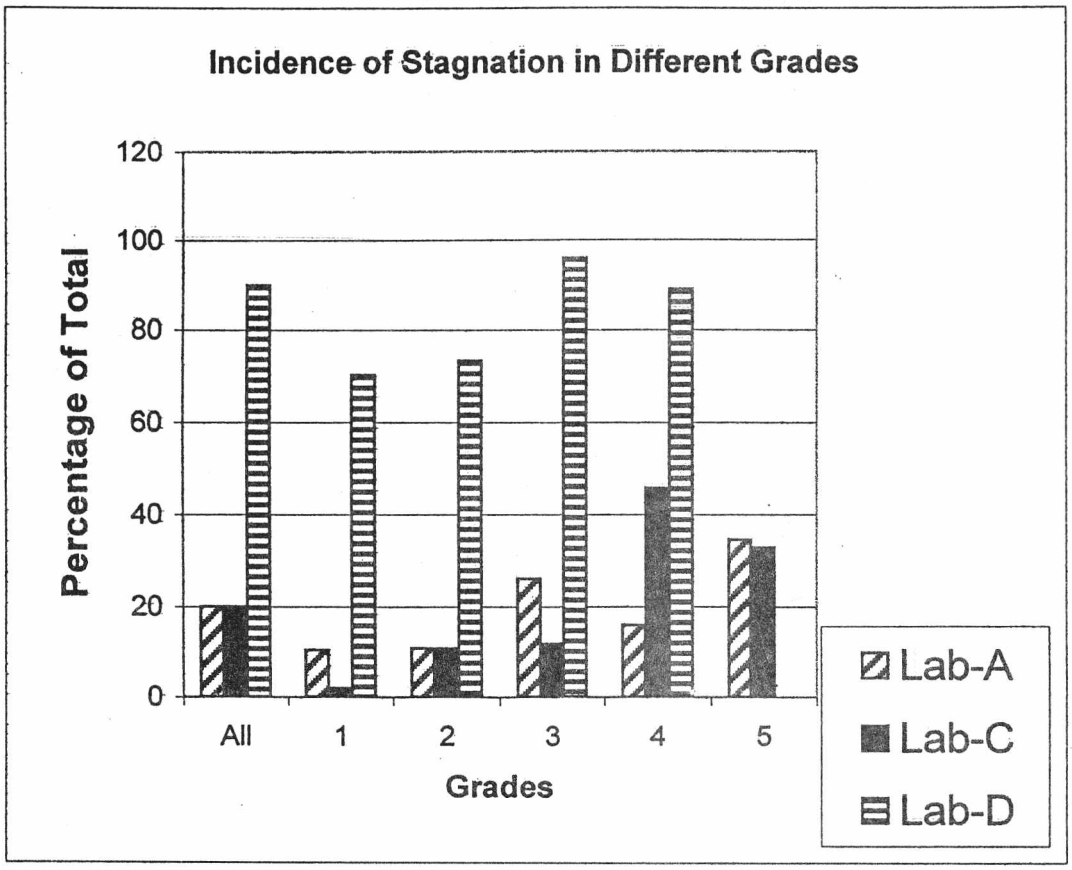

Incidence of Stagnation in Different Grades
Percentage of Total
120
100
80
60
40
20
0
All
1
2
3
4
5
Grades
Lab-A
Lab-C
Lab-D

Fig-4.9C

Section-4.10: Impact of work experience, educational qualification and performance on the probability of promotion

In Section 4.3, we have seen that between the four labs, Lab-A and Lab-B had promotion policy that linked annual performance scores with the number of years of service required to attain eligibility for promotion review. In order to see to what extent these policies were being followed in these organisations, we attempted to collect data on a sample of currently working scientists past performance record and promotion history. Lab-A provided data for 150 scientists. Because of many missing data in either the promotion data or the performance data, we could use only 110 data of 1994. We estimated the probability of promotion using a Logit model. The dependent variable was the promotion in 1994 (Yes = 1 and 0 otherwise). The independent variables were educational qualification dummy, years working in the current post, grade promoted to, and performance scores as dummy variable and behavioural score in a scale of 1 to 25. The estimated coefficients and the Log Likelihood function are shown in Table-4.10A.

Using the estimated coefficients the change in the probabilities are calculated and are shown in Table-4.10B. It can be seen that for promotion from Grade-1 to Grade-2, the probability changes by 0.19 when qualification changes from BE to ME and the change is 0.33 when the qualification changes from BE to Ph.D. when the incumbent has spent 3 years in the existing post and has performance of 75 and behavioural score of 20. The probability rises by 0.21 if the work experience increases from 3years to 4 years for Bachelors with performance at 75 and behavioural score at 20. The probability further rises by 0.10 when performance rises from 67.5 to 75 for Bachelors with work experience of 3 years and behavioural score of 20.

Thus we find that the change in probability due to a change in educational qualification from Be to ME is lower than that due to one year experience in the post. Since it takes two years to acquire a Masters degree so there is a clear disincentive to acquire a Masters degree. And when we consider the effect of Ph.D. we are further disappointed by its impact on the probability of promotion.

The change in the probability of promotion on account of change in the performance score keeping all other variables at constant level indicates that probability rises by only 0.10 when performance rises from 67.5 (excellent) to 75 (outstanding). This change is again less than a corresponding change for addition of one more year of work experience in the same post.

In summary, we find the relative effect of work experience in the grade on the probability of promotion to next higher grade is much more than either due to a higher academic qualification or an one point increase in performance appraisal score.

Table-4.10A

Estimation of probability of promotion using education, work experience, performance dummy and scores of last year in a logit model.

Dependent variable = Promotion in 1994 Yes = 1

Independent variable	Estimated Coefficients
Constant	1.2816 (3.09)
Education dummy	-1.3600 (0.82)
Education dummy	-0.6047 (0.79)
No. of years in the last post	0.8278 (0.205)
Grade promoted to	-0.9199 (0.3047)
Behavioural scores	-0.4096 (0.1098)
Performance 26.2 dummy	-15.3747 (64.2)
Performance 37.5 dummy	------
Performance 45 dummy	-8.325 (30.2)
Performance 56.25 dummy	-1.2603 (1.29)
Performance 67.5 dummy	-0.4496 (0.97)
-2 Ln Likelihood	88.74

( ) Standard errors

Table-4.10B

Probability of promotion in 1994 calculated using logistic regression

Grade Promoted to	Ed1	Ed2	Time taken	Behaviour Score in year	Performance Score in year	Probability of promotion
2	0	0	3	20	75	0.39
2	1	0	3	20	75	0.58
2	0	1	3	20	75	0.72
2	0	0	3	20	67.5	0.29
2	1	0	3	20	67.5	0.47
2	0	1	3	20	67.5	0.62
2	0	0	4	20	75	0.60
2	1	0	4	20	75	0.76
2	0	1	4	20	75	0.85
3	0	0	3	20	75	0.37
3	1	0	3	20	75	0.56
3	0	1	3	20	75	0.69
3	0	0	3	25	75	0.17
3	1	0	3	25	75	0.30
3	0	1	3	25	75	

Ed1 = 1 If education is Masters

= 0 Otherwise

Ed2 = 1 if education is Ph.D.

= 0 Otherwise

Section 4.11: Nature of Turnover

i. Percentage lost by way of turnover and the percentage gained by way of recruitment in last five years and their quality

Fig-4.11A shows the trend in the loss of manpower by way of resignation and the percentage change in manpower due to recruitment in last five years. Details are shown in Table-4.11A. From this table, it can be seen that in than last five years from 1990-1995, Lab-A lost 14.2% of its manpower due to resignation while by way of recruitment it has gained 20%. Thus there was a net gain of 6% in five year. This is not very high considering that it does not include manpower requirement to take care of superannuation. The picture is more disturbing for Lab-B. It lost 16.7% of its manpower but gained by way of new recruitment only 11% in five years. Thus this lab has experienced a net loss of 5.7% of its manpower in last five years. The picture will look extremely grim and disappointing if we add the natural loss of manpower due to superannuation to this voluntary loss. The very existence of the organisation can be at stake if urgent steps are not initiated to reverse this trend. The actual loss of manpower by resignation in Lab-C and Lab-D were quite small as such no analysis was attempted.

ii. Educational Composition of Manpower Lost by way of Resignation

Table-4.11B shows the educational composition of personnel who left the organisation and that of those who joined the organisation in last five years. Lab-A data file for the personnel who quit job had only two types of qualifications listed viz. Ph.D and without Ph.D. No details about actual qualification of non-Ph.Ds were available in their tape. Thus we could compare only the percentage of Ph.Ds in the groups who left job and the group who joined in last five years. From the table it can be seen that the percentage of Ph.D in the group that left was 36.4% compared with only 23% in the new recruit group. Thus by way of resignation Lab-A was loosing more human capital intensive manpower than what they were getting in from the market.

In Lab-B, the percentage of Masters degree holders was 17% in the group that left the organisation while it was only 13% in the group that joined in the last five years. Thus

in term of loss of human capital intensity due to resignation, the picture is no different. Though the actual impact on the organisation is likely to be different because of the existence of quite low human capital intensity of Lab-B. It is to be noted that both Lab-A and Lab-B have in-house facility to acquire higher academic degrees. But as we have seen in Section-46, only 15.3% of the current manpower of Lab-B could utilise this facility in the past. Thus there is urgent need to initiate policy to attract and retain more qualified professionals in Lab-B. These trends are shown in Fig-4.11B.

iii. Average Years of Service and Average Age at Leaving Time and the Grade at which they quit

Table-4.11C shows the average years of service at the time of leaving and the average age at which they quit. In Lab-A, the people who left the organisation did so after an average of 9.1 years of service and at an average age of 37 years. And, in Lab-B they did so after 12.5 years of service and at an average age of 35.6 years. Thus it appears most of the people who left the organisation did so after considerable number of years of service and many of them left in their most productive service years of 30-40 years. These trends are shown in Fig-4.11C

Table-4.11D shows the distribution of grade of these professionals who left the organisation. From this distribution, it appears in Lab-A, most people left when they were either in Grade-1 or in Grade-2. Few people left after they have reached a grade above Grade-2. Though there were a few who left even after reaching Grade-5 or Grade-6. These were possibly the cases where decisions were more due to family reasons than for professional or career reasons. These trends are shown in Fig-4.11D.

In Lab-B, most of the turnover took place from Grade-2 i.e. after getting at least one promotion since joining. Thus it would be interesting to see how these professionals moved up in the first few levels that they have crossed during their stay in these organisation.

iv. Average Age of Reaching the Last Grade

Table-4.11E shows the average age at which the quitters and the existing professionals reached different grades. In Lab-A, both the currently working scientists and the quitters reached Grade-2 at an average age of 32 years. Grade-3 was reached at an average age of 41.4 years by the currently working scientists and at 41.6 years by the

quitters. Again the average age are quite comparable. However, both Grade-4 and Grade-5 were reached at a lower age by the quitters than those of the currently working scientists. Grade-3 was reached at an average age of 42.2 years by the quitters compared to 45.3 year of the current scientists. Grade-4 was reached at an average age of 44.2 years by the quitters compared to 48.5 years by the current scientists. Thus looking at the average age at which leaving time grades were reached by the professionals who left Lab-A, it is not obvious and certain that slower promotion rate was the reason for their decision.

In Lab-B, the currently working scientists reached Grade-2 at an average age of 34.9 years compared 30.4 years taken by the quitters. Grade-3 was reached at an average age of 42.1 years by the existing scientists compared to 41.3 years of the quitters. Thus it appears, on the average the first two promotions was obtained at a faster rate by the quitters than the existing scientists. These trends are shown in Fig-4.11E1 and Fig-4.11E2 for Lab-A and Lab-B respectively.

It is to be noted that though the quitters' average age of reaching their last grade was less than the existing scientists, this no means prove they have crossed all the previous grade at a faster rate than the current scientists. It could happen than, they got all previous promotions at a faster rate but in their last grade they were passed too many times. Thus it is necessary to see the average tenure in their last grade at the time of leaving. This is shown in table-4.11F.

v. Average Tenure in the Last Grade

From Table-411F, it can be seen that in Lab-A, the average tenure of the scientist who left the organisation was less than those are working now. This more pronounced in Grade-1 and Grade-2 from which maximum turnover took place. The average tenure of the quitters was 3.35 years in Grade-1 at the time of their leaving compared to 3.7 years of those who are working now. The average tenure was 3.1 years in Grade-2 by those who left compared to 4.2 years by those who are working now. In Grade-3, the average tenure at the time of leaving was 3 years by those who left compared to 4.4 years by those who stayed back. Because the first few grades are most turnover prone grades, it indicates that longer tenure was possibly not the reason for quitting the organisation.

In Lab-B, the picture was slightly different. In Grade-2 and Grade-3 the average tenure at the time of leaving was 2.8 years and 3.4 years while it was 2.5 years for those who are working now. Thus the average tenure at the time of resignation was possibly slightly more than those who stayed back. Though it need not be so. Because we are comparing with the tenure of those who are working in those grades now not at the time when actual resignation ha taken place. These trends are shown in Fig-4.11F1 and Fig-4.11F2 for Lab-A and Lab-B respectively.

Thus looking at the promotion rates and the average tenure at the time of quitting, we find that slower promotion is not a very important reason for taking those decision.

In summary, we find there is serious imbalance between rate of recruitment and rate of loss of manpower by resignation in a few organisations. A few organisations are loosing more manpower of higher level of human capital intensity than that they were getting by way of recruitment. Voluntary resignations takes place after quite good number of years of service in the organisation and quite often after their first promotion in the organisation. Those who leave need not be the slow movers in the hierarchy.

Table-4.11A

Percentage lost by Turnover Vs Gained by Recruitment in last five years

Lab-A		Lab-B		Lab-C		Lab-D	
Lost	Gained	Lost	Gained	Lost	Gained	Lost	Gained
14.2%	20%	16.7%	11%	0.005%	12.6%	Negligible	3%

Table-4.11B

Percentage of Ph.D and Masters in the Lost Pool Vs those in the New Recruit Pool

Education	Lab-A		Lab-B		Lab-C		Lab-D	
	Lost	New Recruits	Lost	New Recruits	Lost	New Recruits	Lost	New Recruits
Masters	----	------	17%	13%	----	-----	----	-----
Ph.D	36.4%	23%	----	----	-----	----	----	----

Table-4.11C

Average years of service and average age at leaving time

Service and Age in Years

Quantity	Lab-A	Lab-B	Lab-C	Lab-D
Mean years of service in the organisation	9.1 Yrs	12.5 Yrs	----	----
Mean Age	37 Yrs	35.6 Yrs	----	----

Table- 4.11D

Percentage distribution of leaving time grade of those who left the organisation

Grade	Lab-A	Lab-B	Lab-C	Lab-D
1	39.4%	----	----	----
2	27.3%	80%		
3	12.1%	17.1%		
4	9%	2.8%		
5	9%	----		
6	3%	----		

Table-4.11E

Average age at which the last grade was reached by those who left Vs those who are working now.

Last Grade	Average age at which reached							
	Lab-A		Lab-B		Lab-C		Lab-D	
	Existing	Left	Existing	Left	Existing	Left	Existing	Left
1	27.7	26.0	------	-----	------	-----	------	-----
2	32.0	32.0	34.9	30.4	------	-----	------	-----
3	41.4	41.6	42.1	41.3	------	-----	------	-----
4	45.3	42.2	45.9	----	------	-----	------	-----
5	48.5	44.2	48.9	----	------	-----	------	-----
6	51.3	53.4	52.4	----	------	-----	------	-----

Table-4.11F

Average Tenure in last grade at leaving time Vs the average tenure of others who are working now

Last Grade	Lab-A		Lab-B		Lab-C		Lab-D	
	Existing	Left	Existing	Left	Existing	Left	Existing	Left
1	3.7	3.35	-----	-----	------	-----	------	-----
2	4.2	3.1	2.5	2.8	------	-----	------	-----
3	4.4	3.0	2.5	3.4	------	-----	------	-----
4	3.5	5.4	2.0	---	------	-----	------	-----
5	4.5	5.5	2.0	---	------	-----	------	-----
6	6.2	2.1	1.0		------	-----	------	-----

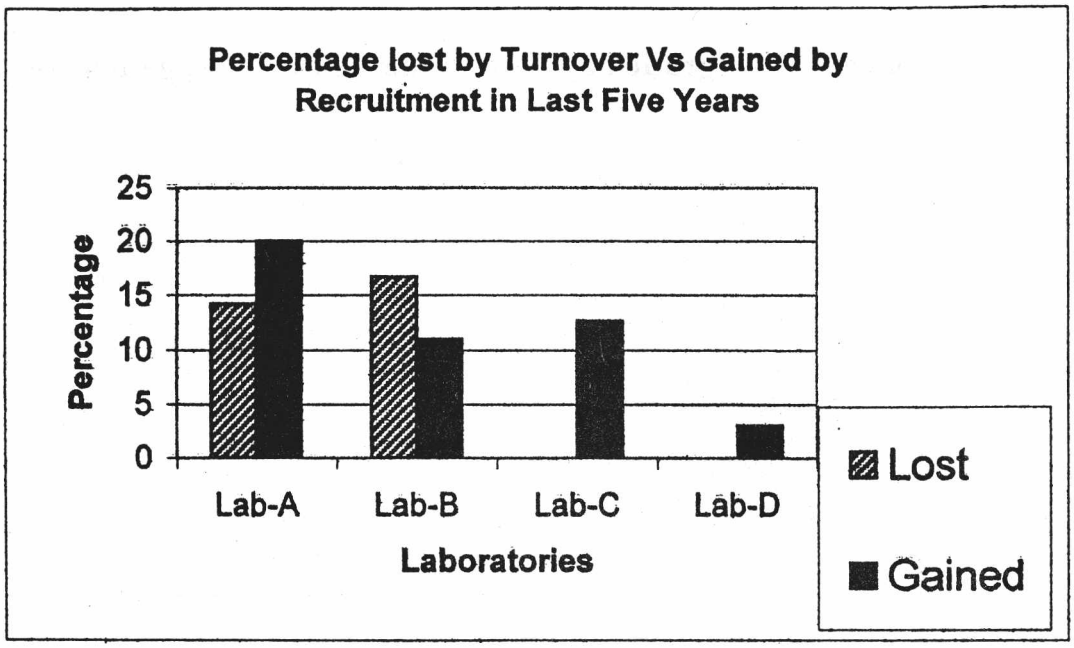


Fig-4.11A

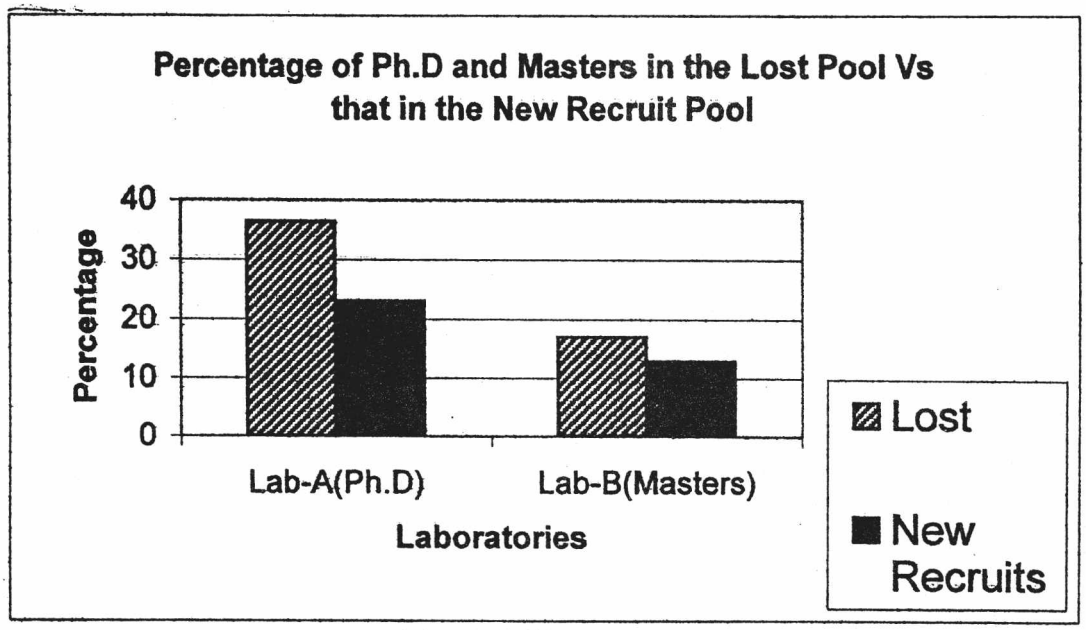


Fig-4.11B

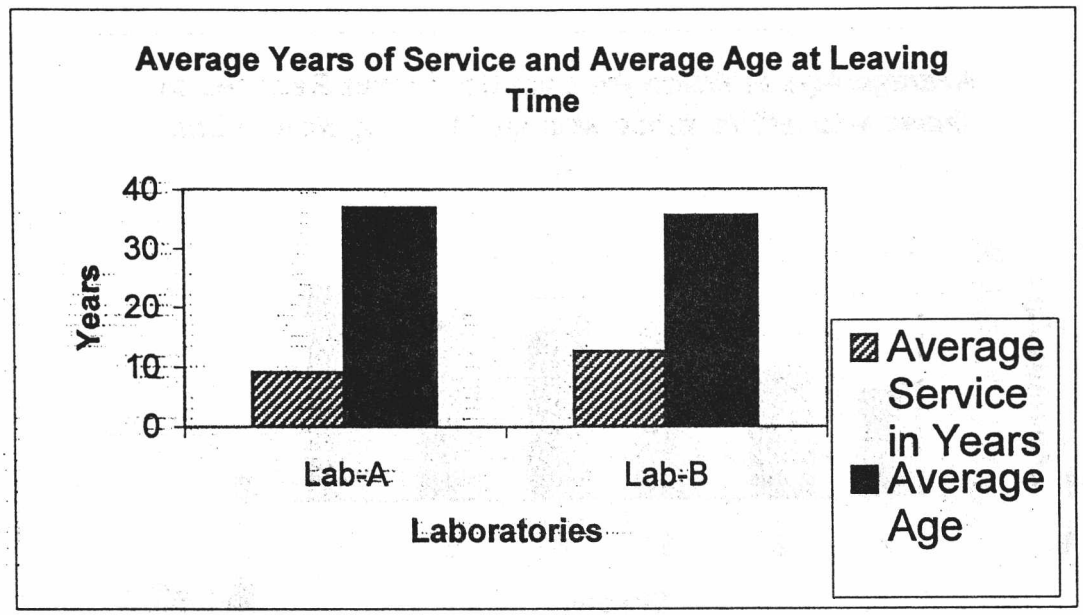


Fig-4.11C

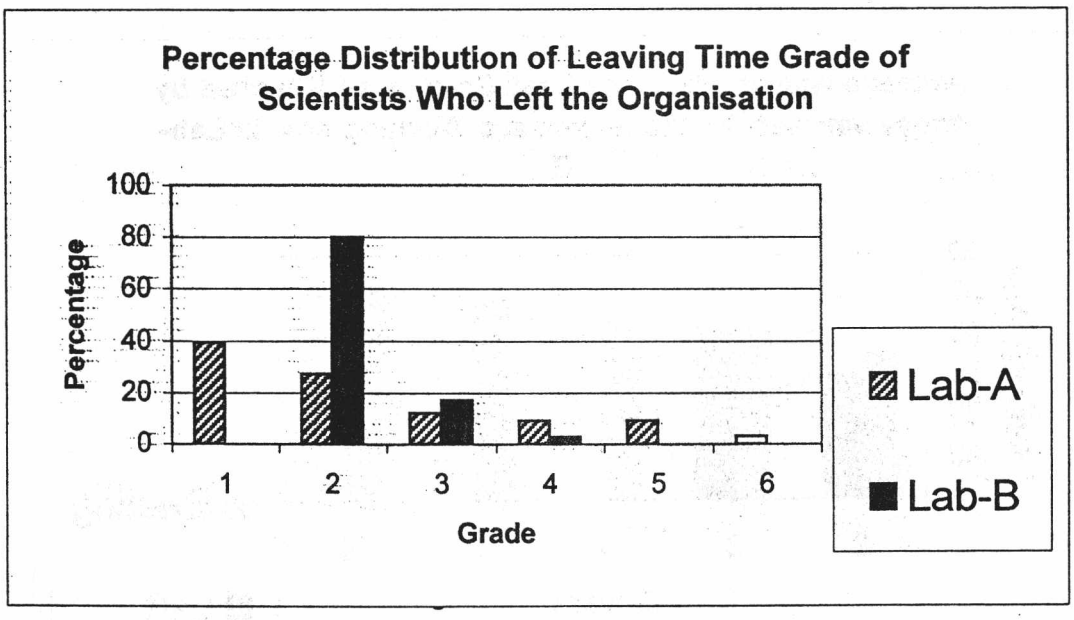


Fig-4.11D

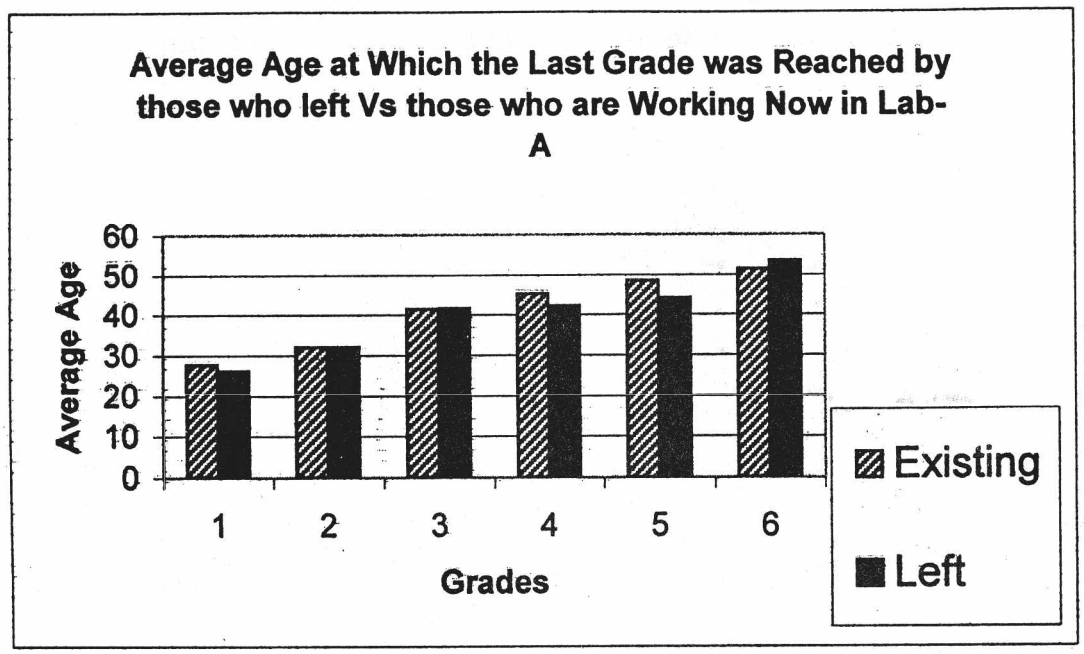


Fig-4.11E1

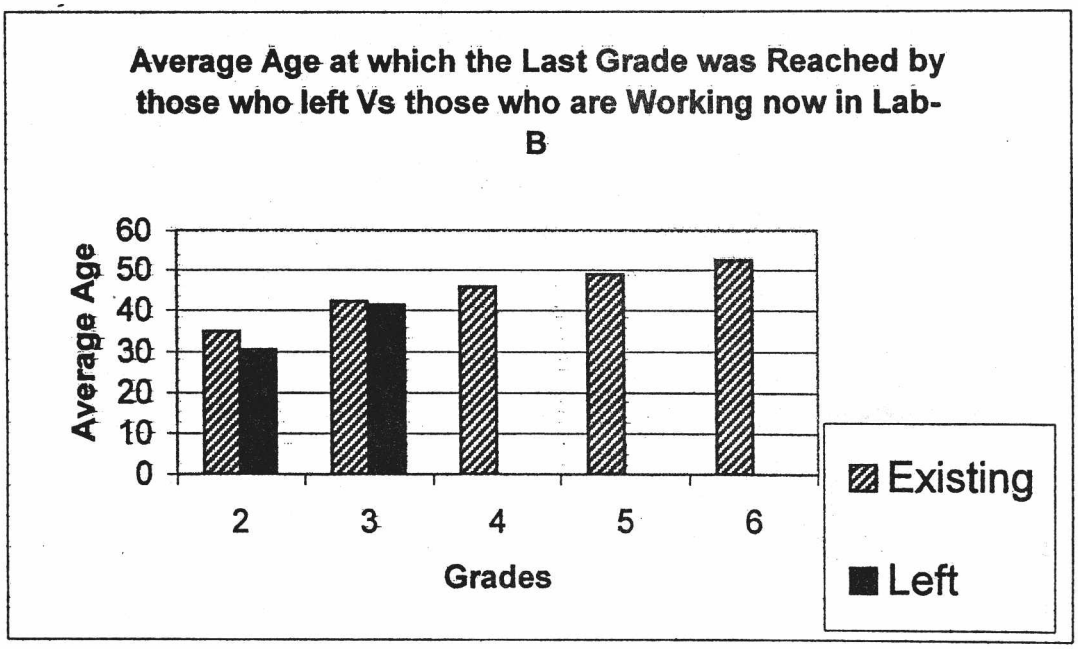


Fig-4.11E2

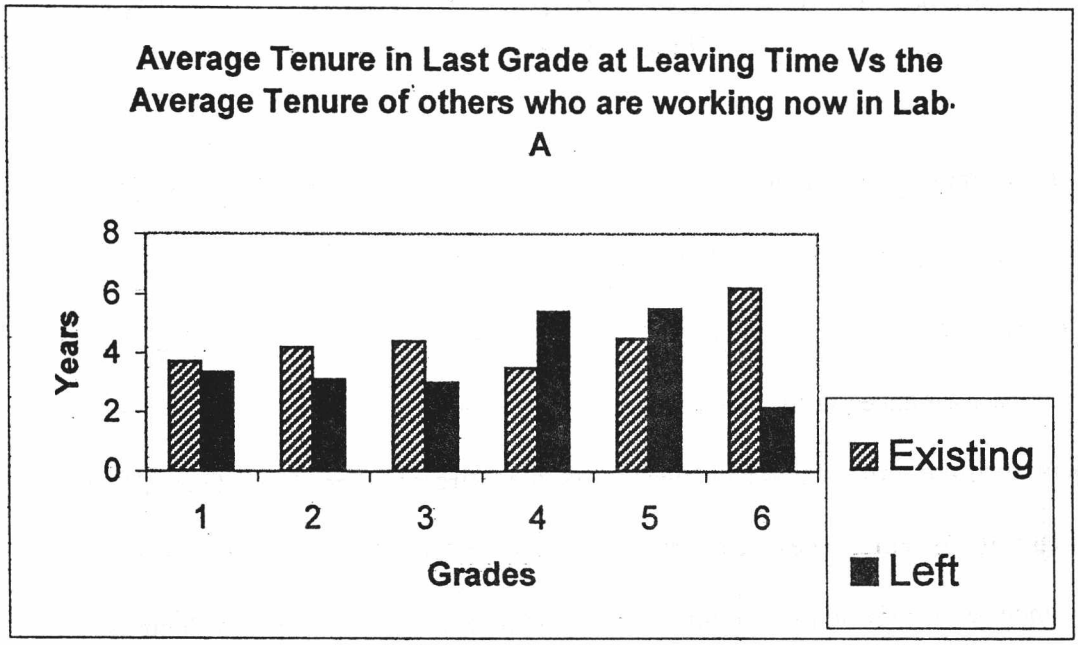


Fig-4.11F1

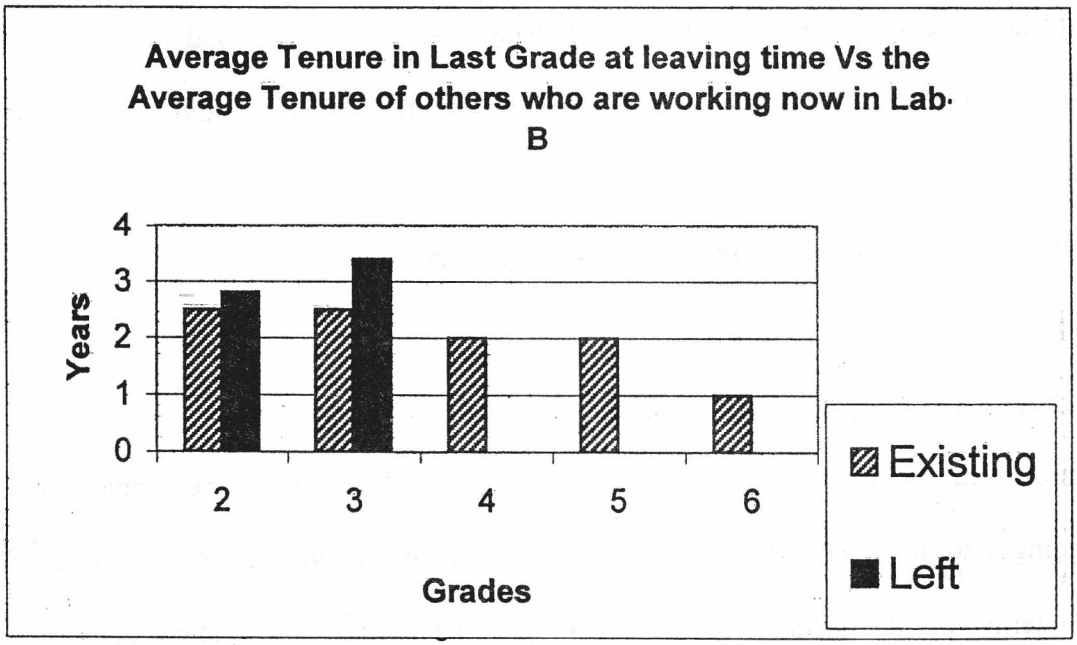


Fig-4.11F2

Section-4.12: Nature of Performance and Behavioural Scores Distributions

Performance of personnel is a desired goal of any organisation. Organisational human resource policies in general and reward policies in particular are designed to get a better performance of employees. As we have noted in Section-3, all the four labs measured performance of the scientists on a regular basis and this measurement was always in absolute terms. However, because of the extreme secrecy and fear of litigation from disgruntled employees, Government organisations keep the whole record of performance as a confidential document. As such getting access to this document was quite difficult. With considerable persuasion, we could get performance appraisal data on a sample of 50% of the working scientists from Lab-A over a period of 10 years from 1985-1995. However, because these data was not used much for any other purpose except once at the time of promotion, data maintenance was not very good. There was considerable missing series in these file. Thus only a limited analysis could be done on these data.

i. Nature of Distribution of Performance Scores

Fig-4.12A shows the distribution of performance scores over the range from lowest of 26.5 and highest of 75 for the three years of 1993, 1994 and 1995. From this distribution it can be seen that about 10% of the scientists get the highest performance of 'outstanding' and about 80% remain in the median category of very good to excellent. Thus in terms of identifying superior performers, the annual performance appraisal system identifies 10% of the population as very high performers. Details of distribution are shown in Table-4.12A.

ii. Performance Scores Over Time

Table-4.12B shows the performance scores of scientists over time. Here we have tried to track the performance score of scientists over three years from 1993 to 1995. We have presented the percentage of scientists who have maintained the same score for two years and three years in a row. We have also presented the percentages whose score decreased and increased over their scores in 1993. All the percentages are calculated with reference to the number with the corresponding score in 1993. However, because of some missing data some of the presented percentages may be underestimated.

From this table it can be seen that, in 1993 6 persons had the score of 75 of which 83% maintained the same score of 75 in 1994 and rest 17% got lower score. Out of this 6, 67% got the score of 75 again in 1995 and the rest 33% got lower score. Thus about 80% scientist are able to maintain high score 'outstanding' for two years in a row and about 67% are able to do so for three years in a row. The next highest score of 67.5 was obtained by 55 scientists of which 69% was able to get the same score in 1994 and 32.7% was able to get the same score in 1995 also. 11% was able to increased their score in 1994 and 20% got lower score in 1994. In the third year of 1995, 16% got increased score while 51.3% got lower score. The next highest score of 56.5 was obtained by 69 scientists in 1993 of which 49% was able to retain the scare in 1994 and 26% in 1995 also. 40% was able to increased their score in 1994 while 11% got lower score than 1993. In 1995, 37.7% got higher score than 1993 while 37% got lower score than that in 1993.

From the trend in the percentage of scientists who are able to maintain their performance over two and three years we find this percentages are high when the corresponding scores are high. As much as 67% of the top performers are able to maintain their top performance over three years in a row. Change in the score is more when the previous year score was low.

iii. Higher Academic Qualification and Performance

Table-4.12C shows the average performance and behavioural appraisal scores for Bachelors, Masters and Ph.D degree holders in 1993, 1994 and 1995.

In 1993, the average performance scores of Bachelors, Masters and Ph.D degree holders were 59.2, 57.2 and 63.2 respectively. The average behavioural scores were 18.6, 17.8 and 20.2 respectively. In 1994, the average performance scores of Bachelors, Masters and Ph.Ds were 61.4, 59 and 63.2 respectively. The corresponding behavioural scores were 19.1, 18.6 and 20.9 respectively. And, in 1995 the average performance scores of Bachelors, Masters and Ph.D were 56, 60.2 and 64.4 respectively with corresponding behavioural scores as 17.7, 18.8 and 20.9 respectively.

Thus it appears, the average performance and behavioural scores of more qualified professionals were better than those with lower qualifications. It was more consistent for Ph.D degree holders than that of the Masters. In 1993 and in 1994, the average performance and behavioural scores of Bachelors were relatively better than the masters.

The general trend of the pattern of performance and behavioural scores are shown in Fig4.12C1 and Fig-4.12C2. These trends indicate that in Lab-A, average performance

and behavioural scores were higher for more qualified scientists than their colleagues with lower academic qualifications.

iv. Performance and Behavioural Scores by Grade.

Table-4.12D shows the variation of average performance and behavioural appraisal scores as we move up in the hierarchy for the year 1993, 1994 and 1995. This table shows in 1995, the average performance scores of persons working in Grade-1 was 53.9, those working in Grade-2 was 61.6. And that in Grade-3, Grad-4 and Grade-5 were 57.7, 62.2 and 68.6 respectively. The corresponding behavioural scores were 21.6, 19.0, 18.0, 18.4 and 20.7 respectively.

The trend of performance and behavioural scores are shown in Fig-4.12D1 and Fig 4.12D2. Comparing the average performance and behavioural score of scientists working in different grades, we find with a few exception, in any year the scientists in higher grade tend to get higher performance and behavioural score than those in the lower grades.

v. Performance and Behavioural Appraisal Scores by source of recruits

Table-412E shows the average performance and behavioural scores of scientists who joined the Lab-A fresh from college at an age less than 25 years of age and those who joined at an age of 30 years or more.

In 1995, the average performance and behavioural scores of lateral entry scientists or those who joined at age above 30 years were 65..4 and 19.5 respectively. The corresponding scores for those fresh from college were 58.6 and 18.8 respectively. In 1994, the average performance and behavioural scores of lateral entry were 64.8 and 20.1

respectively . The corresponding scores for the fresh recruits were 60.6 and 18.9. Thus both in 1994 and in 1995 the average performance and behavioural appraisal scores of lateral entry scientists were better and than those who joined fresh from college. The picture is no difficult in 1993 either. These trends are shown in Fig-4.12E1, and Fig-4.12E2.

Thus it appears that scientists who join the organisation after completing all their academic degrees or after acquiring some work experience elsewhere do better than those who join fresh from college either without completing any other academic degree above the basic degree in engineering or without acquiring some work experience in some other organisations.

vi. Distribution of Performance and Behavioural scores of those stagnating more than six years in same grade

Table-412F shows the distribution of performance and behavioural scores of those who missed their promotion successively two times in a row. The trends are shown in Fig-4.12F1 and Fig-4.12F2 for performance and Behavioural scores respectively. These group of scientists who missed their normal promotions two times in a row can be considered as plateued in their career. From the sample of data for which performance appraisals were given, we could get performance and behavioural scores of 36 scientists. Their distribution of performance indicate that their performance was no different from others. There 11% with the highest performance of 75 or 'outstanding', 33.3% had score of 67.5 i.e. 'Excellent', 33.3% had score of 56.25 i.e. 'very good', 2.8% had score of 45 i.e. 'good'. This distribution compares very well with the general distribution of performance as was noted in previous paragraphs. The

second row of the table shows the distribution of behavioural scores. As much as 33% of the stagnating scientists had behavioural score 20 and above. The most disturbing picture is that about 11% have had performance at the top of the scale. Along with this when we consider that about 40% maintains there top performance for three years in a row, we are hard put to find reason for their stagnation for six years in a row. This indicates performance alone is not sufficient for promotion. It may be recalled that in Lab-A, promotion depends on three factor, one's performance appraisal score, peer review score and score in the promotion interview. Thus it indicates that possibly some of these scientists received lower scores in their peer review and or in the interview.

In summary, we find performance of scientists are influenced by their educational qualification, by their current grade and by the career stage at which they joined the organisation. Scientists who joins with some work experience and or after completing all their academic training generally do better than those who joins fresh from college without any work experience or without completing their academic training. It was further observed that stagnation in the same grade need not be due to poor performance or low behavioural scores.

Table-41.2 A

Distribution of performance (Only in Lab-A)

Percentage of total

Performance score	1995	1994	1993
75 (Outstanding)	11%	8%	4.2%
67.5 (Excellent)	41%	49.3%	38.5%
56.5 (Very Good)	43%	34.6%	48.3%
45 (Good)	3%	6.6%	7%
37.5 (Satisfactory)	1%	0	
26.25 (Fair)	0	1.5%	1.4%

Table-4.12B

Change of Performance Scores over Time

Score	1993 Number got	1994 Percentage of 1993	1995 Percentage of 1993
75	6	Same 83% Decreased 17%	Same 67% Decreased 33%
67.5	55	Same 69% Decreased 20% Increased 11%	Same 32.7% Decreased 51.3% Increased 16%
56.5	69	Same 49% Decreased 11% Increased 40%	Same 26.1% Decreased 37.2% Increased 37.7%

Table-4.12C
Performance and Behavioural scores by Qualification(Only Lab-A)

Average performance Scores

Education	1995		1994		1993	
	Perf	Beh	Perf	Beh	Perf	Beh
BE	56	17.7	61.4	19.1	59.2	18.6
ME	60.2	18.8	59	18.6	57.2	17.8
Ph.D	64.4	20.9	63.2	20.9	63.2	20.2

Table-4.12D
Performance and Behavioural scores in Different Grades

Average Performance Scores

Grade	1995		1994		1993	
	Perf	Beh	Perf	Beh	Perf	Beh
5	68.6	22.1	63.6	20.7	63.3	19.7
4	62.2	19.7	62.5	18.4	61.6	18.7
3	57.8	16.2	58.6	18.0	56.6	17.3
2	61.6	19.3	59.7	19.0	57.7	18.9
1	53.9	18.5	65.9	21.6	62.6	20.8

Table-4.12E

Performance and behavioural scores by source of recruits (Lateral Entry and Fresh recruits)(Only Lab-A)

Average performance scores

Type of recruits	1995		1994		1993	
	Performance Score	Behavior Score	Performance Score	Behavior Score	Performance Score	Behavior Score
Lateral	65.4	19.5	64.8	20.1	61.4	19.5
Fresh	58.6	18.8	60.6	18.9	59.6	18.6

Table-4.12F

Distribution of performance and Behavioural Scores of personnel who were stagnating in the same grade for more than 6 years (Lab-A only)

Total no. of persons	Scores in 1995	Percentage of total	Mean Score
	Performance		61.8
36	75	11%	
	67.5	33.3%	
	56.25	33.3%	
	45	2.8%	
	26.2	2.8%	
	Missing score	16.7%	
	Behavioural Scores		
	25	2.8%	
	23	11.1%	
	22	11.1%	
	20	8.3%	
	19	2.8%	
	18	2.8%	
	17	8.3%	
	16	2.8%	
	14	5.6%	
	13 or less	16.7%	
	Missing	25%	

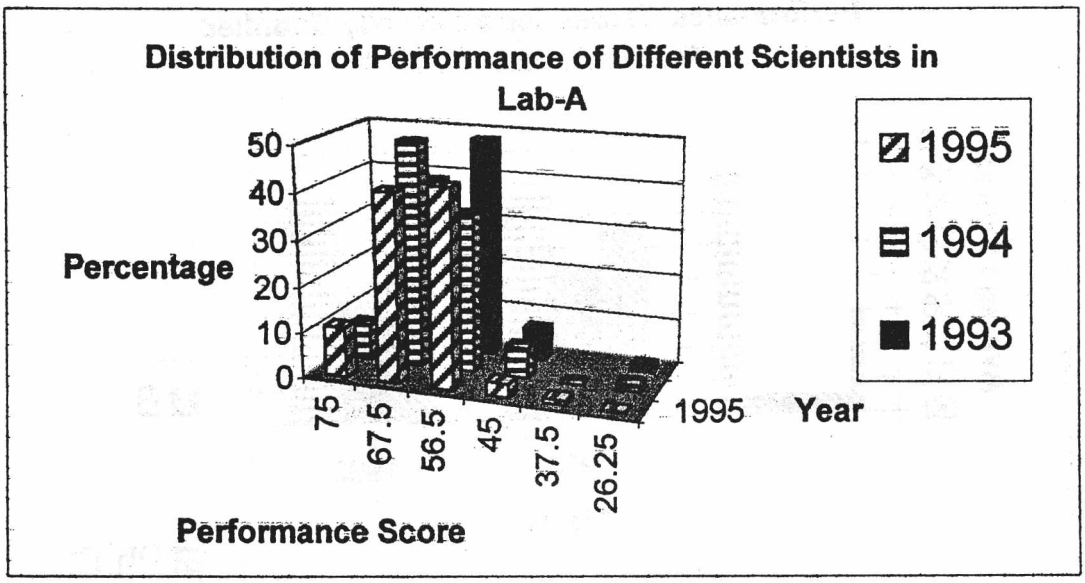

Distribution of Performance of Different Scientists in Lab-A
Percentage
50
40
30
20
10
0
75
67.5
56.5
45
37.5
26.25
Performance Score
1995
Year
1995
1994
1993

Fig-4.12A

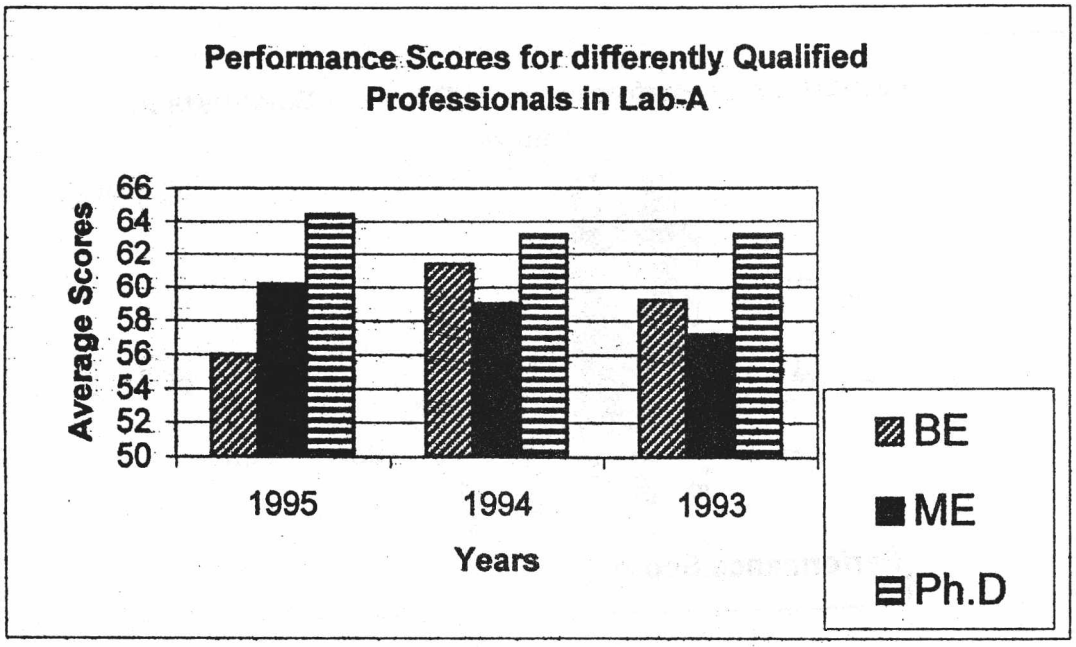
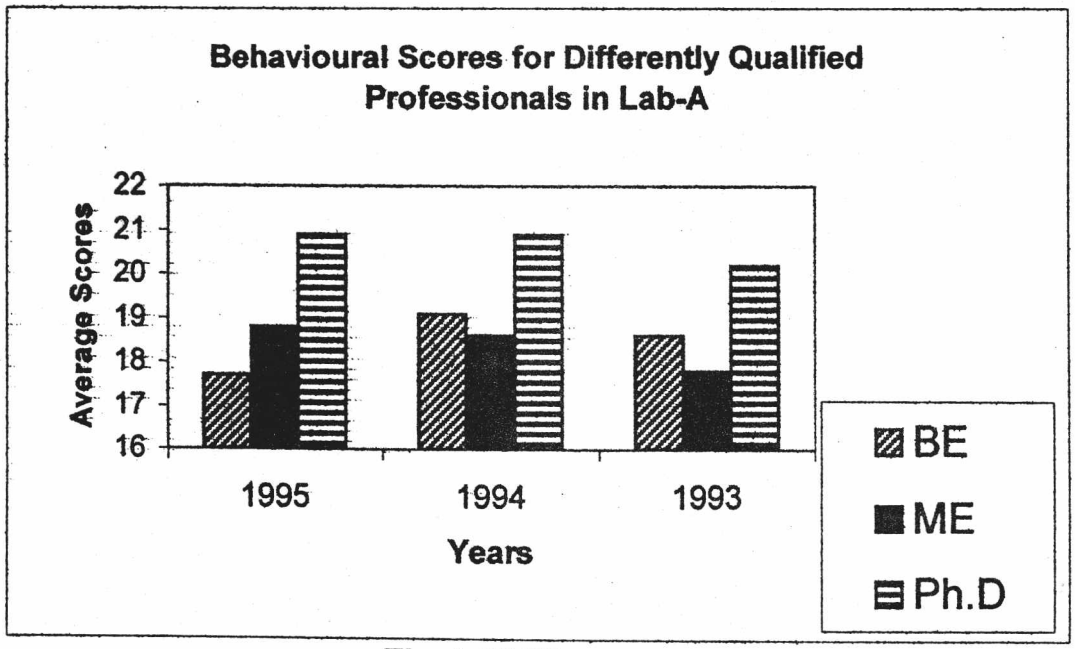


Fig-4.12C1



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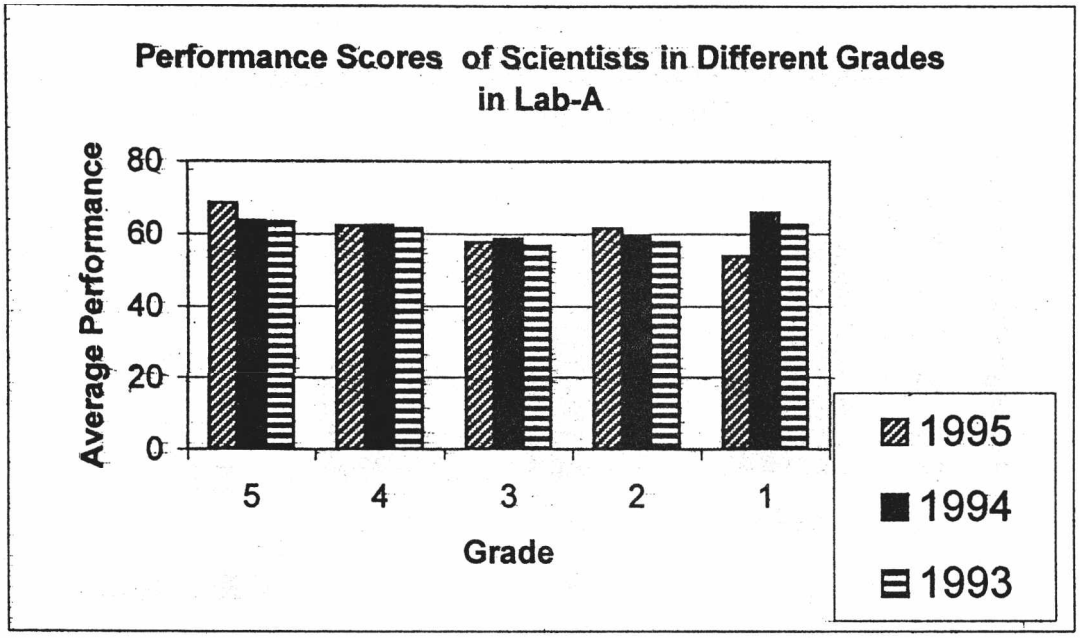


Fig-4.12D1

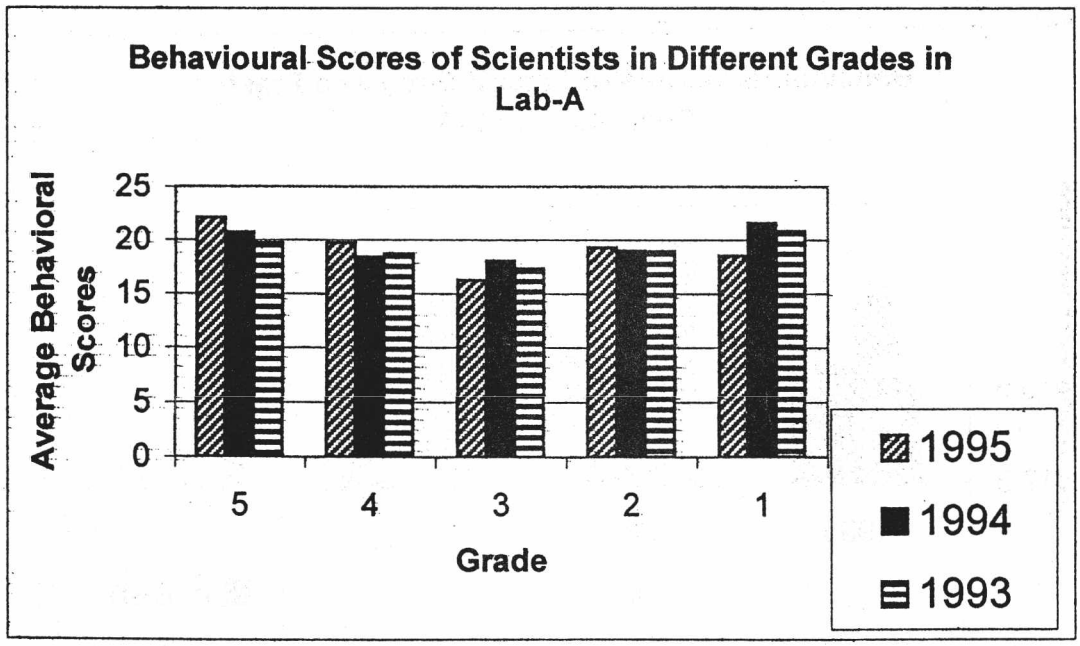
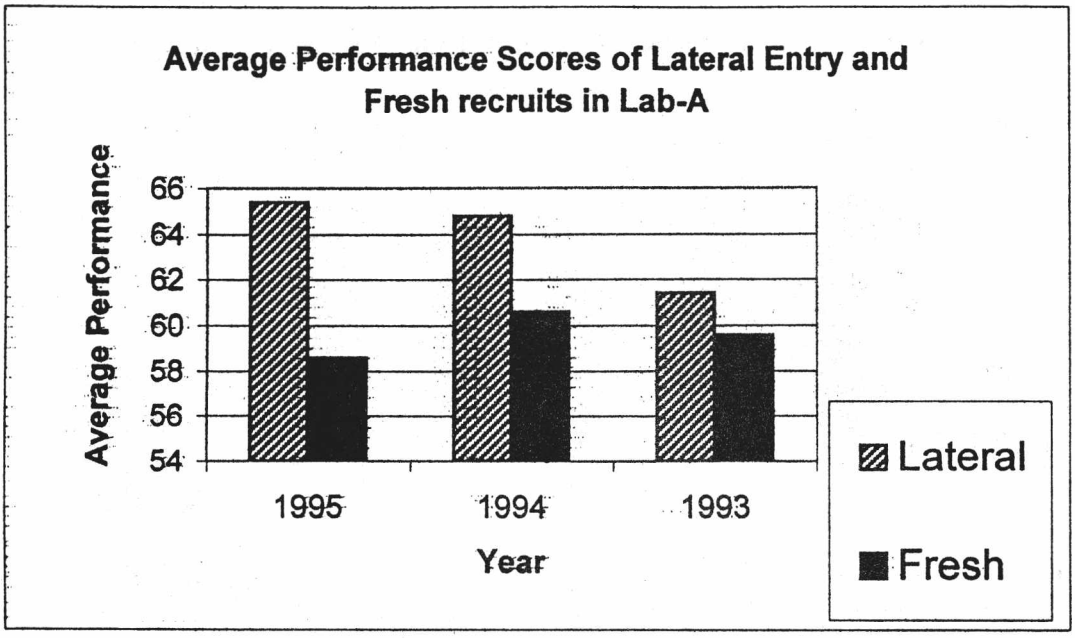


Fig-4.12D2



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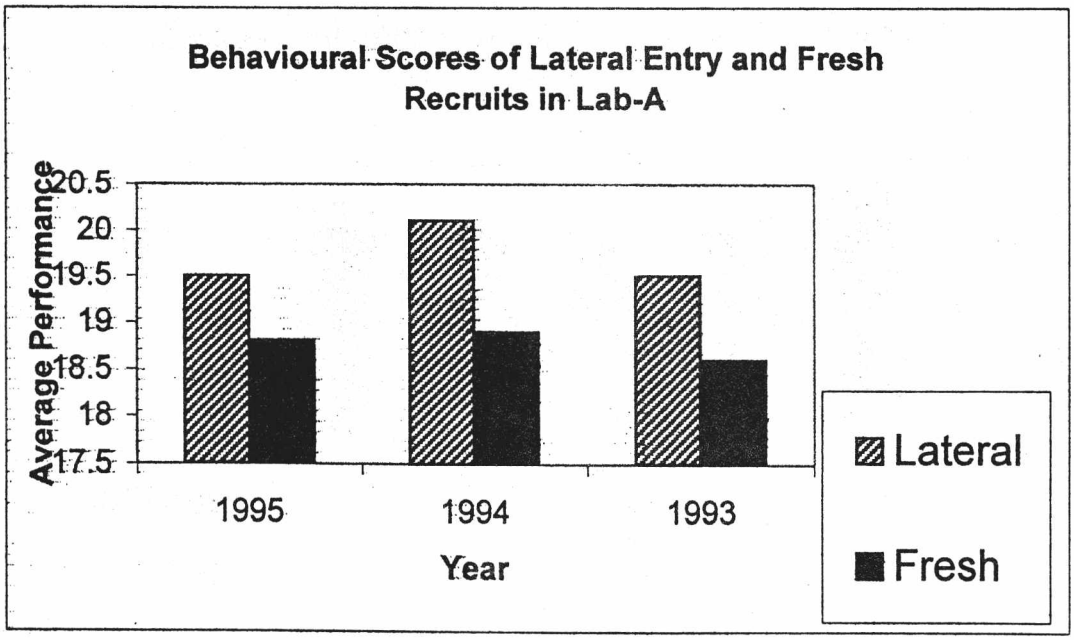

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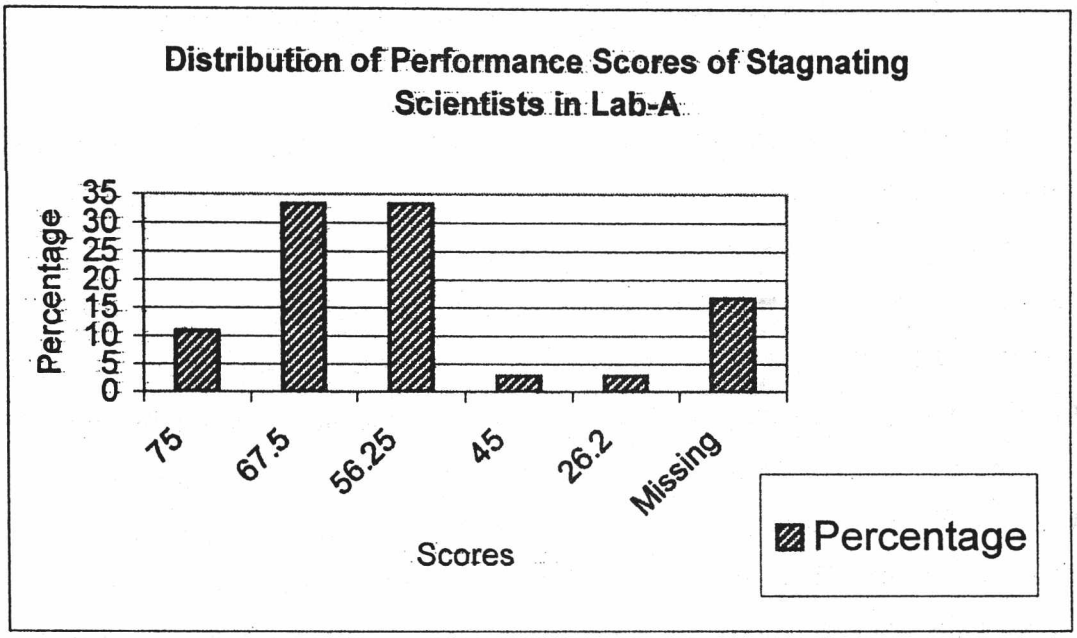

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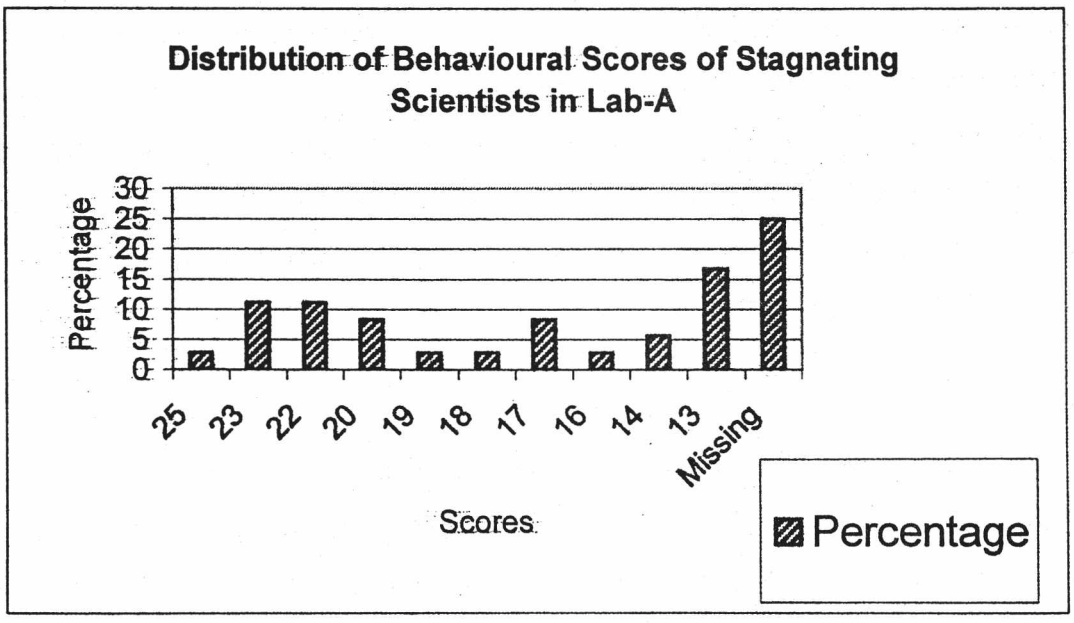

Fig-4.12F2

Section 4.13: Non-promotion Type Rewards

Promotion in the hierarchy is a very visible form of rewards for superior performance. However, though it is a powerful and effective reward, it cannot be used very often and over a large number of personnel at a time. Promotion makes a permanent change in ones relative status and income within the organisation. Thus unless the organisation is growing at a rapid pace, a promotion based reward system cannot be sustained very long. To maintain motivation of the personnel, any organisation must find ways to reward them without jeopardising the overall viability and existence of the organisation. The problem is more acute in Government organisation, which does not sell its service for profit. Thus Government organisation need to find rewards and awards whose financial implications to the organisation are not very high yet the individual awardees are happy and satisfied with it. Non-promotion type rewards and awards are a few of these means.

Table-4.13 shows the various types of non-promotion awards and the frequency of their use in the recent past. From this table it can be seen that except in Lab-B, most of the labs do not have very many alternative awards to reward outstanding performance of their scientists. In Lab-A, the only non-promotion type awards that are being used are the Annual Foundation day awards which is given to about 4% to 5% of the scientists. In Lab-B, there are six different types of awards. Apart from their social significance, many of these awards are of considerable financial significance to the recipients. In the recent past about 15% to 16% scientists were given one or the other of these awards. It is to be noted that many of the awards that were used by Lab-B in the recent past were equally applicable and available to scientists in Lab-A and Lab-C also. The only difference is that these awards are not being used in these other labs inspite of their availability.

Lab-C uses functional designation e.g. Project Director, Manager etc as a form of award for outstanding performance. They do not have and do not use any other non-promotion type awards. However, because these functional designations are temporary short duration type as such they are likely to have temporary motivational effect on individual. It is also important to see that these functional designations are not very much correlated with organisational designation or immediate history of promotion, lest it

looses its separate significance as recognition for performance. Because of absence of any data on the current awardees, we could not do any analysis on this matter.

Lab-D has quite a good number of awards. As many as 12 different types of awards are there. Many of these awards are of considerable financial significance to the recipients. However, the frequency of use of these awards seems to be quite low. Their record of use in last five years from 1990-95 indicated, that only 15 scientists from these lab received any of these awards. Thus only 0.5% of the currently working scientists received the awards in a year. This is quite small considering the fact that as many as 8% to 10% scientists in any lab are superior performers.

In summary, it appears the number and types of non-promotion awards in all the organisations are highly restrictive and even when they are available, they are not being used in sufficiently frequently.

Table-4.13

Non-promotion awards and the frequency of their use in the recent past

Lab-A	Lab-B	Lab-C	Lab-D
Only one type of award viz. the Foundation day awards are in use. In 1995, about 4% scientists were given this award.	A total of six different types of awards are there and in 1997, about 16% scientists received these awards	Only non-promotion type award is Functional Designation e.g. Project Director, Managers etc. No data on frequency was available.	A Total of 12 different awards are there. However between 1990 to 1995, only 15 scientists received any of these awards. Thus in a year about 0.5% scientists received any non-promotion type awards.

Chapter-5: Treatment of Scientific Services in The Central Pay Commission Reports.

Section 5.1: Setting of Pay Scales by the Central Pay Commissions

The Central Pay Commissions takes into account a number of criteria to set the position, number and the scale widths for different grades. Some of the important issues that they considered in the past were

i. Minimum emolument that a Government employee should get in a month.
ii. Maximum salary of a Government employee.
iii. No. of pay scales for all varieties of jobs must be progressively reduced and bring an uniformity in pay scales across departments.
iv. Maintaining relativity with other sectors e.g. private sector, public sector and state sector.
v. Maintaining relative positions of different grades from the previous pay commissions
vi. Total financial implication of the new pay scale.

Among this different conditions, one issue is very very critical and that is the minimum salary that a Government employee should get. This minimum salary estimation takes into account the per capita national income, minimum salary recommended by the previous pay commission, growth rate of national income and the consumer price index. The minimum salary of a Government employee recommended by the First Central Pay Commission was Rs55/- per month. The Second Central Pay Commission recommended Rs80/- per month. Third Central Pay Commission recommended Rs185/- per month but was modified to Rs196/- at the time of implementation. Fourth Central Pay Commission recommended minimum pay of Rs750/- per month. Recently completed Fifth Central Pay Commission recommended minimum pay of Rs2440/- per month for Government servant.

The second important tasks of the Pay Commissions were to decide on the appropriate number of pay grades for all the varieties of Government jobs in different

department. One of the difficulties faced by the Pay Commission in this task was to understand the varied nature and complexities of jobs in different Government departments and came up with an appropriate number of pay scales. Past Pay Commission felt the need for Job Evaluation but was never attempted because of lack of resources, time and expertise. It was noted that the actual number of operating grades exceeded the number of recommended grade after their implementation. Example. Third Pay Commission recommended a total of 80 scales but by the time Fourth Pay Commission was formed there was 153 pay scale operating. Fourth pay commission recommended only 36 Pay Scales for all the jobs but by the time Fifth Pay Commission was formed there were 52 Pay Scales running. The Fifth Pay Commission recommended for only 33 Pay Scales. We do not know how many scales would be operating after a few years !. This highlights the varieties of jobs performed by Government employees in different department and the need for a thorough understanding of the uniqueness of the jobs in some departments.

The Pay Scales as recommended by the last three pay Commissions are shown in Table-5A. From this table it can be seen that every Pay Commission attempted to merge a number of similar grades and recommended a common pay scale across departments. This was done because they did not find any great difference in the nature of tasks and the nature of skill required to perform those different jobs. There was considerable scope of inter-changeability between personnel working in those departments having separate pay scales. The plethora of pay grades were noted as remnants of history rather than an operational necessity.

Section 5.2: Relative Growth in Minimum Pay of Different Grades as Recommended by last three Pay Commissions

Table-5B shows the minimum pay in different grades and the percentage change in this minimum pay as recommended by the last Three Central Pay Commissions viz. Third Central Pay Commission, Fourth Central Pay Commission and the Fifth central Pay Commission. The entry grade of Grade-1 required an academic qualification of a Masters in Science or a Bachelors in Engineering. We have included a Grade-0 which was generally filled by promotion from non-supervisory cadre but in some Department this grade was used as an entry-level job for qualified Science and Technology professionals.

From 3rd to 4th Pay Commission the grade minimum increased by more than 200% in different grades. At the entry grade the minimum pay increased by 314%. The increase in pay minimum across grades were not uniform. The percentage increase decreased with increasing grade. At the entry level the minimum increased by 314% but at the top Grade-9 it increased by only 229%. Now if we include the differential tax rate and differential inflation adjustment policies followed by successive Governments, we find that from Third Pay Commission to Fourth Pay Commission the relative income position of higher level jobs relative has actually fallen. This discrepancy was noted and rectified to some extent by the Fifth Pay Commission by maintaining almost same percentage increase in both the entry level as well as the topmost levels.

From Fourth and Fifth Pay Commission the grade minimum have gone up by more than 300% in all the grades. At the entry level the grade minimum has gone up by 364% while that at the top grade of Grade-9 it has gone up by 325%. Thus the relative position is more or less maintained. However, it does not include the higher tax rate and lower inflation adjustment of gross pay for the top levels!

Table-5C shows the relative pay at the minimum of the grade with respect to the minimum salary of the Government employee as recommended by different Pay Commissions. The relative position of a grade vis-à-vis the lowest paid Government employee signify the relative value of the service as perceived by the Pay Commission.. The position of the entry grade was at 3.57 and the highest grade of Grade-9 was at 17.86 as recommended by the Third Pay Commission. In Fourth pay Commission these positions were at 2.66 and 10.67. Thus in relations to the value of lowest paid Government employee service, the value of all scientific services came down to almost half its level after the fourth Pay Commission. However, it was reduction in relative standing of different jobs across all categories of jobs. As a result it might not have affected the general supply of manpower in the R & D sector. But such a drastic reduction in relative value might have affected their motivation to work hard.

After the Fifth pay Commission recommendation the relative position of the entry grade and top grade minimum were at 2.66 and 10.65 respectively. Thus between Fourth and Fifth Pay Commission recommendations there was no significant change in the

positions of the Grades. Fifth Pay Commission practically froze the relative position arrived at by the Fourth Pay Commission.

Section: 5.3: Change in the Median Pay of Different Grades as Recommended by the last three Pay Commissions

Grade minimum indicates the starting pay of the grade which can work as an appropriate incentive when a person is just joining the service with only the required educational qualification, work experience and skill. Due to highly overlapping pay system, this grade minimum has no significance to internal candidates. Because by the time an internal candidate become eligible for higher grade, most often his pay already crosses the minimum of the next higher grade. Thus unless there are a lot of recruitment from outside in the middle ranks, this grade minimum losses its significance as a motivational tool. For the internal candidates, the grade median pay can work as a powerful motivational tool. They can look forward to that kind of average pay on promotion.

Table -5C shows the median pay of different grades as recommended by the last three Pay Commissions. This table shows that from Third Pay Commission to Fourth Pay Commission the median pay for Grade-1 rose by 310% while that for the highest grade of Grade-9 it rose by 230%. Thus again we find the erosion of relative position of the employees working in higher grades. There was a secular decrease in this ratio as one moved up in the hierarchy. From Fourth to Fifth pay commission however, there was not much of a difference in the rise of median pay in lower and higher grades.

Table-5D shows the relative position of the grade median pay relative to the minimum pay of Government employee as recommended by the different pay commissions. The position of median pay of grade-1 was 5.1 relative to the minimum pay of Rs196/- as recommended by the third Pay Commission. The corresponding position for Grade-9 was 17.86. After the Fourth Pay Commission the grade this relative positions of Grade-1 and Grade-9 were at 4.13 and 10.7 respectively. Thus the relative position of median pay for all grades relative to the recommended minimum salary of a Government servant came down to almost half to what was it before the fourth Pay Commission. The relative position did not show any significant change after the Fifth pay

Commission. Fifth Pay Commission froze the scales at almost the same relative position that was there after the Fourth Pay Commission.

Section 5.4: Relative Position of Different Grades in terms of Minimum and Median Pay as Recommended by Different Pay Commissions

A high relative positions of a grades with respect to the entry grade works as an incentive to currently working personnel to work harder for early promotion. This is particularly more so at the entry level when one's learning ability is better and desire for learning is high. This is also the time of high expectation. It is more so in scientific services than in other profession because of the unique aptitude and aspiration of these professionals. An expectation at this stage may lead quick change in organisation and profession because personal investment in learning the ropes of the trade is not so high. A high gap in the minimum pay at this level may work as an appropriate incentive to work hard and stay in the profession. It will work as a risk premium to the individual to remain in a risky profession.

Table-5F shows the percentage increase in minimum pay when one goes from a lower grade to higher grade as recommended by the last three Pay Commissions. The difference between the grade minimum of Grade-1 and Grade-2 was 57.1% as recommended by the Third pay Commission. Fourth Pay Commission recommended a gap of 36.4% between these two grades. Fifth Pay Commission recommended a gap of only 25% between the first two grades. Thus we find the difference in the minimum pay between the first two grades are decreasing progressively. Since there was no change in the education and experience requirement for the grades, this change in relative standing may affect the power of the next higher grade to influence behaviour and attitude of the entry grade professionals.

Table-5G shows the difference between the median pay for different grades as recommended by the pay Commissions. The difference between the grade median at entry grade and the next higher grade was 35% after the Third pay Commission and this gap came down to 20% after the Fourth pay Commission and after Fifth pay Commission it rose to 26.5%. Since median pay can go up due to increase in maximum side of the grade range, so a small increase from 20% to 26.5% between fourth and fifth pay Commissions may be due to extension of the range of pay for Grade-2. Since scientists

and technologist generally look for recognition immediately on completion of a specific task that he can claim as his own achievement, this kind of delayed recognition possibly does no good to individual motivation to work harder or to stay in the profession.

In summary, we find though the relative position of different grades were maintained well during 4th and 5th Pay Commissions but because the relative standing was seriously affected in post 4th Pay Commission the net result is that all the grades are relatively less valued now after 5th Pay Commission than they were before. Given the increasing complexity of technology, motivation and learning would play a far more important role than just work experience. An appropriate financial incentive in keeping with this self-investment in learning is very crucial for success of both the individual and the organisation. It is more so at the first stage of the career than at a later stage, By the time one reaches the late stage, one accumulates considerable success and made considerable investment in learning the trade. Naturally, stakes are high against changing organisation or profession. It is not so at the entry stage. Here ability is high and so is the expectation of recognition. Along with that the cost of changing job and profession are low. Naturally an appropriate human resource and compensation policy at this stage is very very crucial to stem the outflow of talented professionals.

Section 5.5: Career Development Policy in Past Pay Commissions

First Central Pay Commission (Ministry of Finance, 1947): There was no special category of workers or officers by the name of scientific cadre. There was however, some comments about the need of scientific workers of some specific departments e.g. Railways, Meteorological department, agricultural Department etc.

Second Central Pay Commission (Ministry of Finance, 1959): This pay commission recognised the scientific staff as a special category and had lengthy discussion on their pay and service conditions. However, they did not include any special grade for them.

Third Central Pay Commission (Ministry of Finance, 1973): They had quite an elaborate discussion on scientific services and recommended introduction of "Flexible Complementing System" on a trial basis in a few Department as special promotion scheme for employees working in scientific departments. This scheme allowed an employee to get promotion to next higher grade irrespective of the availability of vacancy. This was applicable to first three grades of the scientific staffs.

Fourth Central Pay Commission (Ministry of Finance, 1986): This pay commission also had elaborate discussion on the scientific and research workers. They recommended continuation of the 'Flexible Complementing Scheme" and recommended for its strict implementation on the basis of objective assessment of performance and merit.

Fifth Central Pay Commission (Ministry of Finance, 1997): For the first time, it went into details of activities and appreciated the career risk and hard work undertaken by research workers in India. In order to encourage more and more people into R & D activities, it recommended a faster career development scheme for research workers- a short of dual ladder scheme. Based on the major activities, it made two categories among the employees working in scientific departments viz. R & D personnel and R & D Administrator. The R & D administrator would be working mainly in the Secretariat and Head Quarters offices providing the administrative support to core research activity of the Department. R & D personnel are primarily involved in knowledge generation and application of knowledge to create new products, materials and services

It recommended application of the concept of Flexible Complementing Scheme strictly for R & D personnel from the for all grades from entry grade to SAG grade i.e. Rs5900-7300 pre-revised scale. It stipulated a minimum service requirement for application of FCS as follows

Grade	Service Required
Rs2200	3 years
Rs3000	4 years
Rs3700	4 year
Rs4500	5 Years
Rs5100	5 Years
Rs5900	5 Years

It also recommended some relaxation in the minimum service requirement for exceptionally meritorious candidates. The relaxation is 1 year and only on two occasions in the entire career.

The Commission also recommended abolition of Fast Track Scheme that was between Grade-1 (Rs2200----) and Grade-3 (Rs3700...) as was being followed in some

Departments. Instead they advised the use of Flexible Complementing Scheme for all departments uniformly.

Fast Track Scheme

Since the Third Pay Commissions, Department of Atomic Energy had a special category of pay grade for superior performers. Some of the characteristics of these grades were unlike other normal pay grades, this pay scales were non-overlapping and of shorter duration with higher annual increment facility. It was created to encourage talented professionals in their early career. There was three such pay grades as follows

Grade	Fast Track Scale	Normal Scale
C	Rs750-50-1000	Rs700-40-1100-50-1300
D	Rs1100-70-1450	Rs1100-50-1300-60-1600
E	Rs1500-80-1900	Rs1500-50-1800-100-2000

Thus in the fast track the annual increment was Rs50/- while in the normal scale it was Rs40. The Duration of the fast track was 5 years while the normal scale duration was 14 years. The idea was that if one did well on a fast track scale, one would get promotion to next higher grade well before hitting the grade ceiling. On the other hand if one did not do so well as was expected, then one would hit the grade maximum too soon and would stagnate until and unless performance reached the expected standard.

Though the scheme was good. However, because of poor implementations there was too many complaints of abuse by the management. Fifth Pay Commission has recommended removal of this grade.

All in all we find the past Pay Commissions had indeed gone into the need for a separate career development scheme. It recognised the special types of jobs done by R & D workers and recommended the use of dual ladder scheme that are increasing followed by multinational corporation for their research workers. It is a welcome development. However, such a radical change in career development policy require a more thorough analysis on the career expectation of scientists and other research worker. Further, the issue of how such a differential career policy can be implemented was not considered by seriously. In terms of pay structure, there seems

to be poor appreciation of differential learning and career aspirations of ordinary engineering workers doing repetitive jobs and R & D workers doing non-repetitive and creative jobs.

Table-5A

Origin of the Current Pay Scale and the Recommendation of Fifth Pay Commission

Third Pay Comm	Fourth Pay Commission	Fifth Pay Commission
650-45-1100-50-1200 **650-30-740-35-880-40-1200**	**2000-60-2300--75-3200-100-3500** 2000-3200	6500-200-10,500
700-40-1100-50-1300 700-1600 900-1400	**2200-75-2800-100-4000** 2300-100-5000	8000-275-13500
1100-1500 1100-1600 1200-1600 1200-1700 1300-1800 1100-1800	**3000-100-3500-125-4500** 3000-100-5000 3000-3625	10000-325-15200
1500-50-1800 1500-60-1800 1500-80-1900-100-200 1500-50-1800-100-2000 1500-100-2000 1600-100-2000	**3700-125-4700-150-5000** 3700-4450 3700-5700	12000-375-16,500 12000-375-18,000
1650-75-1800 1800-100-2000 1800-2250	4100-125-4850-150-5300	14300-400-18300
1500-2500 2000-2500 2000-2250	**4500-150-5700**	14300-400-18300
2250-2750	**5100-150-6300-220-6700**	16400-450-20000
2500-3000	**5900-200-7300** **5900-200-6700**	18400-500-22400
3000-3500	**7300-200-7500-250-8000**	22400-600-26000
3500	**8000**	26000-600-26000

* Highlighted scales were meant for scientists and engineers.

Table-5B

Percentage Change in Minimum Pay of Grades Between Pay Commissions

Grade	Third Pay Commission Scale Minimum Rs	Fourth Pay Commission Scale Minimum Rs	Fifth Pay Commission Scale Minimum Rs	Change from 3rd to 4th Multiple	Change from 4th to 5th Multiple
0	650	2000	6500	3.07	3.25
1	700	2200	8000	3.14	3.64
2	1100	3000	10000	2.73	3.33
3	1500	3700	12000	2.47	3.24
4	1800	4100	14300	2.27	3.49
5	2000	4500	14300	2.25	3.17
6	2250	5100	16400	2.27	3.21
7	2500	5900	18400	2.36	3.12
8	3000	7300	22400	2.43	3.1
9	3500	8000	26000	2.29	3.25

Table- 5C

Positions of Grade minimum relative to minimum emolument of a Government servant as assumed and recommended by different Pay Commissions

Grade	3rd Pay Commission	4th Pay Commission	5th Pay Commission
0	3.31	2.66	2.66
1	3.57	2.93	3.27
2	5.61	4.0	4.10
3	7.65	4.93	4.91
4	9.18	5.47	5.86
5	10.2	6.0	5.86
6	11.47	6.8	6.72
7	12.75	7.87	7.54
8	15.31	9.73	9.18
9	17.86	10.67	10.65

Table-5D

Percentage change in the grade median pay between pay commissions

Grade	Median pay In 3rd Pay Comm	Median pay In 4th Pay Comm	Median pay In 5th Pay Comm	Percentage change between 3rd and 4th	Percentage change between 4th and 5th
0	925	2750	8500	297%	310%
1	1000	3100	10750	310%	350%
2	1350	3750	12600	278%	340%
3	1750	4350	14250	248%	330%
4	2025	4700	16300	232%	346%
5	2250	5100	16300	185%	320%
6	2500	5700	18200	228%	320%
7	2750	6600	20400	240%	310%
8	3250	7450	23450	230%	310%
9	3500	8000	26000	230%	330%

Table- 5E

Positions of Grade median relative to minimum emolument of a Government servant as assumed and recommended by different Pay Commissions

Grade	3rd Pay Commission	4th Pay Commission	5th Pay Commission
0	4.72	3.67	3.48
1	5.10	4.13	4.41
2	6.89	5.0	5.2
3	8.93	5.80	5.84
4	10.3	6.27	6.68
5	11.48	6.80	6.68
6	12.76	7.60	7.46
7	14.03	8.8	8.36
8	16.59	9.9	9.61
9	17.86	10.7	10.66

Table-5F

Relative Position of the Grade Minimum in Different Pay Commissions

Grade	Minimum in 3rd Pay Com	Percentage increase over previous grade	Minimum in 4th Pay Com	Percentage increase over previous grade	Minimum in 5th Pay Com	Percentage increase over previous grade
0	650		2000		6500	
1	700	7.7%	2200	10%	8000	23.1%
2	1100	57.1%	3000	36.4%	10000	25%
3	1500	36.4%	3700	23.3%	12000	25%
4	1800	20%	4100	21.6%	14300	19.2%
5	2000	11.1%	4500	21.6%	14300	19.2%
6	2250	12.5%	5100	13.3%	16400	14.7%
7	2500	11.1%	5900	15.6%	18400	12.2%
8	3000	20%	7300	23.7%	22400	21.7%
9	3500	16.7%	8000	9.6%	26000	16.1%

Table-5G

Relative Position of the Grade Median in Different Pay Commissions

Grade	Median Pay in 3rd Pay Com	Percentage increase over previous grade	Median Pay in 4th Pay Com	Percentage increase over previous grade	Median pay in 5th Pay Com	Percentage increase over previous grade
0	925		2750		8500	
1	1000	8.1%	3100	12.7%	10750	26.5%
2	1350	35%	3750	20%	12600	32.6%
3	1750	29.6%	4350	16%	14250	29.4%
4	2025	15.7%	4700		16300	
5	2250	11.1%	5100	17.2%	16300	14.4%
6	2500	11.1%	5700	11.7%	18200	11.6%
7	2750	10%	6600	15.8%	20400	12.1%
8	3250	18.2%	7450	12.9%	23450	15.1%
9	3500	7.7%	8000	7.4%	26000	10.8%

Chapter - 6: Performance Evaluation and Reward System for Scientists in Other Countries

In view of the strategic nature of career policies for R&D professionals, published data are quite scanty. We have tried to collect data from various published documents and sources including IAMOT members.

6.1 South Korea: Electronics and Telecommunication Research Institute (URL: http://www.etri.re.kr)

(Source: Personal Communication from a Senior Scientist of the Lab)

(Specific questions on the highlighted items were posed to a scientist from this laboratory. The material below is an exact form of reply was received in the E-Mail)

It is one of the sponsored research institutions in the telecommunication field in South Korea. It gets most of its projects from Govt. and from telecommunication operators. There are 4 kinds of job titles, research, technical staff, administrative staff and technician. Each job title excluding the technician has 3 classes, e.g. principal members, senior members and member.

Rewards for good performance: There are 3 kinds of reward for good performances.

i. Faster promotion in the hierarchy.

ii. Yearly incentive

iii. Royalty

Performance Evaluation : It is called 4p systems.

4P - Paper, patent, program and products.

Paper, patent and program is managed by scores according to level.

First Level - 20 points. S.C.I./SSCI - Science Citation Index or Social Science Citation Index.

Second Level - International Conferences and journals excluding SCI/SSCI - 4 points.

Third Level - 2 points - Domestic paper.

Patent :

Foreign patent - 9 points

Domestic patent - 6 points.

Program : - Counted by program lines.

1500 Lines - 1 point

Royalty Incentive : When a product is transferred to companies, then they can receive royalty incentives.

Entry Level Requirement : - The entry-level academic requirement is now Ph. D. Three years ago it was M.Sc. degree.

Requirement for Promotion: - A minimum of 2 years of experiences is required to attain eligibility. Further, the productivity point should be minimum 40 points in three years time.

Difference in average salary between levels: The average salary of a scientist is about $40,000 before IMF bailout package now it is about $30,000. The difference in average salary between levels is about $10,000.

Incentive for Acquiring Higher Degree: About 10% personnel can attend school to get higher degree.

Turnover : - Average 5% scientists leave in a year. Most move to universities. Generally they leave between 5 to 10 years of services.

Equity with other companies : Compensation system is very similar across companies.

Performance Evaluation System

Two systems -

(1) **Management by result** i.e. 4p systems. This is used to decide as the incentive points.

(2) **Behavioural Result** - Mostly used in companies.

This is a very important component because this decides educational opportunities, promotion and other benefits.

The most important use of performance evaluation is for promotion, educational opportunities and other benefits.

Educational Opportunities.

- Regular education is allowed to 2 or 3 members in a year.
- Part time is allowed to 10% member of each division.
- Sabbatical is offered to about 5 members in a year.

Score Systems for Research Management Systems (SSRMS)

There are four factors to decide the performance called the 4p systems. - Paper, patent, program and products.

There are three grades or qualities.

1st grade - 20 points

2nd grade - 4 points

3rd grade - 2 points.

The individual score is decided by the number of authors as -

Single author - 100%

Two authors - 70% + 30%

Three authors - 70% + 20% + 10%

Patent :

Foreign patent application - 4.5 points.

Domestic patent ..... - 3.0 points

Registration of foreign patent. 9 points

Registration of domestic patent. 6 points

Product :

Factor Scoring Systems

Royalty earning rate (Royalty amount /Amount of Investment of the R&D)

Over 45% - 3 points.

25 - 45% -2.5 points.

15 - 25% - 2 points

5 - 15% -1.5 points.

Amount of Royalty

About 7 millions KRW 3 points

5 - 7 millions 2.5 points

3 - 5 millions 2 points

1 - 3 millions ..... 1.5 points

Under 1 million ..... 1.0 point.

Number of firm participating in technology transfer

Above 5 firms 2 points

4 firms 1.6 points

3 firms 1.2 points

2 firms 0.8 points

1 firm 0.4 point

Formulation of total score:

Total score = Score of royalty earning rate + score for amount of royalty + Score for Technology transfer.

Program.

Program is counted by lines. Base is 1500 lines = 1 point. The some is used only for annual incentive not for promotion.

Factors for Promotion : Three factors.

(1) Accumulated score minimum : 40 points

(2) Performance evaluation = .2 x Yr(t-2) + .3.Yr(t-1) + .5 x Yr(t0).

Minimum score > 50%

(3) Education and training and work experience.

These are the three factors for promotion. Sometimes other factors are also used.

6.2. Australia: CSIRO Systems

(Commonwealth Scientific Industrial Research Organisation)

(Source: CSIRO, Corporate Human Resource, Limestone Avenue Cambell ACT 2601, Postal Address:: P.O. Box. 225 Dickson ACT 2602. Australia).

(The material below is an excerpt from the performance evaluation and reward system followed by CSIRO Australia. In view of the Copyright protection the full document could not be reproduced)

The performance appraisal system in CSIRO is called Performance Planning and evaluation scheme (PPE) and was implemented in 1990. Its objective was to

i. to ensure alignment of individual work activities with organisation.

ii. to create a performance culture.

iii. To provide a basis for reward decision.

(1) Link to Reward.

CSIRO has a competency based classification structure comprising of 9 levels. Each level has a salary range within which incremental steps are specified. Criterions for advancement within and between levels are as follows:

i. **Incremental Advancement**: (i.e. within salary range) : is granted where an individual's performance appraisal has resulted in a ranking in the middle box (i.e. all objective achieved) or better. The appraisal is done on a five-point scale. This assessment which is made by the immediate supervisor, must be confirmed by the next level manager.

ii. **Multiple Increments**: are available to recognise exceptional performance (i.e. where an individual has been rated in the top two boxes for at least two years and has significantly outperformed other staff at the same level). Case for multiple increments are considered by a Reward Review Committee to ensure that fair and consistent studies have been applied.

iii Reclassification (Promotion) to a higher level is available where an individual has been rated in the top two boxes for at least two years and during that period has demonstrated all competence to the standard required at the higher level.

iii. **Cash Bonus Scheme**: A new Enterprise Agreement will introduce cash bonus scheme is under consideration. These will be available where other rewards are not appropriate. This will be subject to approval by a Reward Review Committee.

1. **Recognition of Qualification.**

   CSIRO's salary and condition of service award prescribe minimum salary for specified qualification. There are 3 years degree, 4 years degree and Ph.D. The new enterprise agreement (EA) will vary these provisions so that payment will be required only where there is an operational need for the qualification i.e. possession alone will not establish eligibility.

2. **Reward for work experience.**

   CSIRO has no reward for work experiences or length of service. However, experience can be taken into account when determining the commencing salary of a new appointee.

Performance Planning and Evaluation

(Following is a brief of performance evaluation system in CSIRO)

This form is to be filled up jointly by the individual and his manager. Individual must discuss with his manager his role, work objective and personal development plan.

Personal Details: Individual provides his job classification and other personal information.

Job description: Each member would list key result areas for relevant role

Work objective : Jointly during planning session (Each member should a major objective on following dimensions- work quality, quantity, time, Equal Employment opportunity, occupational health and safety and security related matter.

Classification Standard: Member should identify level of competency in following areas required to achieve the objectives viz. Problem solving, application of knowledge, judgement, independence, communication, resource management, adaptability and research innovation.

Resource and Training Requirements: Member should identify resource and training needed to achieve objectives.

Personal development planning: Member should discuss his personal career goal with his/her manager

Performance Review & Feedback: An elaborate exercise to reach consensus on achievement of objective. This meeting can happen many times in a year. Members are advised to maintain significant event diary for better exchange of information.

Performance Evaluation: Members should do a self-appraisal of own achievement of the year. Documented evidence is preferred.

Appraisal: Manager would appraise the member on a five-point scale. Scales are performance anchored.

Staff member comments : To be completed at the end of the period

Manager's recommendation: For promotion, accelerated advancement and increment.

Review: Next level manager will review the entire record

6.3: Occupational Salary in U.S.

We could not get very much information about the pay and reward system practised in U.S. Govt. or private sectors. Some data on occupational salary we could get from Govt. Publication.

1. Average Salary by Occupation.

Source: **Occupation Outlook Handbook. 1996-97**: US Department of Labour, Bureau of Labour Statistics, Washington D.C. 1996.

The average starting salary of Chemists were $29,000, $38,000 and $52,000 for Graduate, Master and Ph.D. degree holders. Thus the average jump in salary was 29.7% for Masters over graduates and 39% for Ph.D's over Masters.

The median salary of all chemists were $45,400, $53,500 and $66,000 for Graduate, Master and Ph.D. The jump in median salary was 17.8% for Masters, 23.4% for Ph. D over that of the Graduate Chemists.

The average salary for Engineers were $34,100, $40,200 and $55,300 for Graduates, Master and Ph.D. degree holders. The average salary of a Masters degree holder was 26.4% higher than that of a Graduate engineers. The average salary of a Ph.D. engineer was 37% higher than that of a Masters degree.

In general engineering job has a total of eight levels as Engineer-I, II, III, IV, V, VI, VII, VIII. The Median annual engineers were $33,900, $38,500, $44,800, $54,400, $65,400, $78,100, $90,000, $1,05,700 respectively. The salary jump were 13.6%, 16.4%, 21.4%, 20.2%, 19.4%, 15.2% and 17.4% from level II to level VIII. The median salary of all engineers with Bachelors, Masters and Ph.D. were $47,100, $53,200, $62,300 respectively. Thus the jump in median salary were 13% for Masters and 17.1% for Ph.D.

Chapter-7: Concluding remarks, recommendations and Limitations

The present study was undertaken with the objective of understanding pay and reward system being used in a few Government laboratories to attract quality R & D professionals from outside, motivate them to give their best in the organisation and to retain them in the service of the organisation. Specifically, the study looked into the recruitment policies of these laboratories to attract quality and qualified professionals both from universities and from the markets. It looked into the methods followed to measure their performance and achievement on the job and the way these measurement results are used to promote them in the hierarchy. It analysed the present structure of manpower in these laboratories and their success and failure in augmenting both quality and quantity of manpower in recent past. Competitiveness in career outcome of grade and salary across laboratories were also looked into.. The study analysed the career experienced by differently qualified professionals and the rate of return to educational investment over and above the basic degree required to enter the R & D service was estimated. The study looked into the career of scientists who changed their job at least once and compared that with others who never changed their jobs. The level of turnover of manpower was analysed to understand the rate of loss of manpower by resignation and type of people who were leaving the organisations. Performance appraisal scores were analysed to understand the influence of education, and other personal and organisationally conferred status related variables. It also looked onto the effect of performance appraisal score, education and work experience on the probability of promotion. The study documented the various types of non-promotion awards that were used to recognise good performance of the R & D professionals and the frequency of their use in the recent past. Past Pay Commission reports were studied to understand the rationale behind the existing pay scale and career development policies for R & D professionals. The following is a summary of our findings on the above issues.

Recruitment Policy: Our analysis of recruitment policies for R & D professionals in these labs indicated the existence of a non-competitive starting pay both at the entry level

as well at later points in career. The treatment of higher academic qualifications and work experience were quite different in different labs. The immediate financial incentive on joining a higher grade on the strength of a higher academic qualification varied from a low of 13.2% to a high of 23.3% for a Masters in Engineering and from 4.3% to 23.3% for a Ph.D in Engineering. The recruitment policies in some laboratories gave very high importance to work experience with practically no consideration for educational qualification above the basic degree.

Performance Appraisal System: Our study on the existing performance appraisal system in these laboratories indicated that almost all these systems suffer from the following weaknesses. It did not provide adequate guideline to the appraiser as to what performance should lead to what score. The feedback and counselling session did not encourage good communication between appraiser and appraisee. In some laboratories, the performance appraisal form and format were quite elaborate but was remarkably weak in communicating the relations between performance and reward to the professionals.

Promotion Policy: Our analysis of promotion policies showed some labs links performance with minimum service requirements thereby encouraging the personnel to achieve better performance. Some labs did not have any documented policy for encouraging superior performance though they practice it. The promotion policies indicated the financial incentive for showing superior performance by an Engineer with only a Bachelors degree varied from a low of 7.1% to a high of 27.6%. Except in one lab, in general the financial incentive for superior performance was more than a corresponding incentive for educational qualification above the basic degree.

Structure of Current Manpower: Our analyses of current manpower indicated almost all the labs suffer from the shortage of qualified manpower. The median age of current manpower was quite high in a few labs. These labs were under considerable pressure to make adequate recruitment in the coming years.

Career Competitiveness: Our analysis of career outcome of grade and salary across organisations indicated the existence of non-competitive career both in the first stage as well as in the late career of the professionals. The average financial incentives for

educational qualification above the basic degree was also quite different in different labs. The effect of work experience prior to joining the organisation on current basic salary was considerably less than a corresponding experience acquired from within the organisation.

Career of Differently Qualified Professionals: Analysis of career of differently qualified professionals indicated that in most labs, the percentage of professionals who were going for higher academic degree after joining the labs were quite small. This could be due to un-remunerative career prospects for higher qualified professionals in these labs. The difference in average salary in the first stage of career between professionals with Bachelors, Masters and Ph.D were too small to compensate for the opportunity cost of acquiring the higher academic degrees. Though in terms of reaching higher grades higher qualified professionals had an advantage, but in terms actual earning , the difference was not at all attractive. The average rate of return for educational investment above the basic degree was as little as 0.12% for every year of such investment compared to as high as 5% annual growth rate due to work experience.

Lateral Entry: On the efficiency of the labs in recruiting experienced professionals from the market, we found lateral entry as a percentage of total number of scientists was moderate in all the four labs. The lateral entry scientists reached different grades at a relatively higher ages than those who joined fresh from college. Advantage of higher qualification on salary was high when such qualification was combined with mobility experience.

Recent Recruits of Last Five Years: New recruitment as percentage of total currently working manpower was quite small in most labs. In some labs the rates were so low that it could not match even their loss of manpower by resignation. The academic qualification levels of the recent recruits were found to be less than that of the current manpower in most labs. The average age of entry of the recent recruits were higher than those who joined before indicating that in recent years more experienced professionals are joining now. The advantage of outside work experienced in terms of getting to higher grade seemed to accrue only when one joins with a Ph.D and with considerable number of years of experience.

Fast Track: On the existence of fast track career, we found in a few labs there were evidence of fast track career in the sense that two or more promotions in a row was achieved at the shortest possible time. Though such incidents are becoming quite rare now. Along with evidence of fast track career there are good evidence of stagnation in the sense that normal promotion was missed two times in a row by quite a good number of professionals.

Effect of Performance Appraisal Score on Promotion: On the impact of performance appraisal, education and work experience on probability of promotion, we found relative effect of work experience in the current grade on the probability of promotion to next higher grade was more than either due to a higher academic qualification or due to one point rise in performance appraisal score.

Nature of Turnover: On the characteristics of turnover, we found there is serious imbalance between rate of recruitment and rate of loss of manpower by resignation in a few organisations. In most of these laboratories, the rate of recruitment just balanced the rate of loss of manpower by resignation. A few organisations were loosing manpower with higher percentage of qualified people than that they were able to get by recruitment and selection. Voluntary resignation were taking place mostly from either the first or the second grade and after quite a good number of years of service in the organisation and quite often after their first promotion in the organisation. Those who left were not necessarily slow movers in the hierarchy.

Nature of Performance Appraisal Score: On the nature of performance as measured by the annual performance appraisal system, we found performance of scientists were influenced by their educational qualification, by their current grade and by the career stage at which they joined the organisation. Scientists who joined with some work experience and or after completing all their academic training generally did better than those who joined fresh from college without any work experience or without completing their academic training. It was further observed that those who missed their normal promotions two times in a row were not necessarily poor performers indicating a failure of either the performance measurement system or the recognition process. In fact

as many as 10% of these stagnating scientists had performance appraisal score at the top of the scale !

Non-Promotion Awards: On the existence of non-promotion type awards, we found in all the laboratories such awards were very limited in number and even when they were available they were not used very frequently. This shows management reluctance exploring possibilities of recognising good performance by alternative means.

Treatment of Research Services in Pay Commissions: Our study of Pay Commission report indicated, that the past Pay Commissions had indeed gone into the need for a separate career development scheme for R & D professionals. It recognised the special types of jobs done by R & D workers and recommended the use of dual ladder scheme, which was a healthy development. However, implementation of such a system requires considerable research data on career expectation of research workers in India. This point was not addressed at all by the Pay Commission. In terms of pay structure, there seemed to be a poor appreciation of differential learning and career aspirations of R & D professionals doing non-repetitive and innovative jobs and ordinary engineering workers doing routine jobs.

Recommendations

Based on our findings and the literature survey we make the following recommendation to improve the work climate in Government research and development laboratories.

1. **Identification of position of an R & D laboratory on a Technology Scale:** It is important to do a thorough analysis to identify the position of a research laboratory in the continuum from a repetitive, routine type of support service oriented laboratory to highly innovative, creative, product or process development lab. All the different labs under the same Department may not be doing equally creative and innovative works. Its position in the innovation and technology scale can be identified by looking at a few parameters that are found to be associated with innovation and new technology oriented research. Some of these parameters could be nature of research projects, in terms of its duration, structure, manpower requirement, outcome in terms of new concept, new product, new process, technology transfer to other organisation etc. The second point is the structure of annual budget; what

percentages of total budget are being spent on research and what percentages are going to development. This analysis could be carried out over a five years period to see both the inflow of projects as well as outflow of project outcome to understand newness in the activities carried out by the organisation. This will constitute the core activities of the organisation. The third point of the analysis could be to understand the principal mode of recognition that the professionals receive in the organisation. To what extent their individual activities are known to the public at large. In other words, to what extent the social and professional modes of recognition are blocked on strategic grounds. In situations with highly inactive professional and social recognition mode, the organisation may have to devise alternative means to compensate the scientists.

2. **Pay Structure:** The pay structure for the scientists working in a laboratory should reflect its position in the continuum identified in the previous paragraph. Higher entry level pay is desirable in laboratories with highly innovative product or process and very long run oriented research. The pay should also be high where due to strategic reasons the social and professionals recognition modes are very much blocked. While devising a pay structure, it is important to keep in mind that growth expectations and personal investment for productivity growth are considerably higher in early career than that in the late career. The gaps between two pay scales should reflect this possibilities and expectations.
3. **Promotion and Incentive:** Rewards for good performance can be in the form of promotion to next higher grade or multiple increments in the same grade. Promotion to next higher grade involves evaluation of both the current performance as well as potential performance for the next level. Those whose current performance are high but potential performance are low, may be given appropriate number of multiple increments as recognition of their performance. This will prevent development of frustration and discontent against the promotion policy and the committee.
4. **Fast Track Scheme:** A non-overlapping fast track scheme may be developed for very high performers. However, in environment where jobs are most often team oriented, considerable caution must be exercised in its execution lest it disturbs the team spirit. To begin with the scheme can be applied in situations where the job is

mostly done by a professional alone and the posts are more or less "relationship neutral" i.e. jobs where the incumbents performances in core tasks are not very much dependent on human communication and exchange with other members of the organisation. Once a performance oriented culture has taken its root, the scheme may be extended to other jobs. In all cases, a visible and easily verifiable performance indicator must be used to place any person on the fast track. One of the potent seed of discontent and complain against the fast track scheme is this poor management of performance visibility and verifiability.

5. **Performance Appraisal:** Performance appraisal system needs considerable improvement before any innovative reward system become effective and acceptable to the employees. Some of the areas where it needs urgent attention are: 1) Anchoring the measurement scale against appropriate performance; 2) Bringing developmental orientation in the appraisal; 3) Feedback and counselling process needs improvement to bring more participation from the appraisee; 4) There should be periodic audit of the performance appraisal record to ensure its utility and effectiveness; 5) There should be attempt to make the performance appraisal a "**live**" exercise.
6. **Treatment of Higher Education:** Educational attainment and training are the indicators of potential performance in highly complex technological environment. Considering that technological complexity demand conceptual understanding, the starting pay and promotion policies should be such that professionals with educational investment above the basic degree should be able to recover their full cost of differential investment in education within the first five to ten years of their joining in the organisation. After this period they may be placed at par with others. This policy should be explicit and transparent to all members of the organisation. In organisation working in highly complex and frontier area of technology, there may be special need for manpower with higher level of formal education. This organisation may consider linking promotion to higher grade with educational qualification, performance and work experience in the organisation.
7. **Lateral Entry:** A change of job in mid career is a kind of self-selection process whereby people with special skill seek organisation where their skills are better utilised and valued than that in their existing organisation. In research organisations it

is very important that people can leave and join at any point in their career without incurring substantial loss to their career and income. In order to encourage such mobility of scientists across different organisations and department and to attract more specially qualified scientist from outside, it is important to have very clear policy to recruit these specially qualified professionals whose special skill could not be produced inside the organisation. While setting their initial pay and grade, it is important to ensure that their career do not suffer because of their change of organisation. While framing such policy, it is important to consider core activities of the organisation and to what extent individual performance can be considered as relationship neutral. When jobs are highly team oriented and or people dependent established network may prevent easy entry of outside experts and their success. In such situations extensive and attractive lateral entry policy may not be desirable.

8. **Dual Ladder Scheme**: Dual ladder scheme should be implemented in those organisation where there is clear demarcation in types of jobs done by people holding similar ranks but working in different locations. Faster or merit based ladder should be encouraged for those areas where jobs are more technology oriented. However, before implementing such a scheme it is important to understand to what extent the career orientation of the existing research workers are stable over time. At what point in their career there is a convergence in career orientation. Only after knowing this we can decide how long they should have separate career development policy based on the existing job structure. Without knowing this inner expectation and drive, a dual ladder scheme may create a lot of hostility and resentment from others who are deprived of the faster promotion because they happen to be doing administrative job which are not by choice but by design of the organisation structure. These cautions are stemmed from two sources. One; research data on dual career orientation among Indian R & D professionals are non-existent. Two; power drive among the educated workers of South East Asia is very strong.

9. **Non-promotion Awards**: More non-promotion type awards should be created and practised in all R & D organisations. In situation where promotion or other permanent change in status cannot be granted, these non-promotion awards may be given as recognition of outstanding performance. However, visibility and

management commitment in such awards are very crucial to the success of such awards. It is also important that there is wide publicity for such awards so that every body know about it and can work for it.

10. **Career and Policy Competitiveness**: While adopting a new pay, promotion and incentive policies, it is important to maintain a competitive policy with R & D organisations who occupy more or less similar position in the innovation and technology scale.
11. **Human Resource Information System:** Last but not the least important of our recommendation is to pay attention to build a comprehensive Human Resource Information System for each of our laboratories. During the study we found Lab-A and Lab-C have very well developed Human Resource Information system. This system may be rented or borrowed for other labs. A comprehensive HR system should contain information on current activities as well as on their prior background including jobs done. Such readily available information can be very useful not only in evaluative analysis like the present one but also to understand a laboratories' capabilities, strengths and weaknesses to position itself optimally in the market.

Limitation and Scope for Further Studies

One of the obvious limitations of the present studies is that we have studied only one lab from each of the four Departments of the Government. Though same policies are followed in all the laboratories working under the same department yet the actual career outcome is very depend on the actual practice of the organization. However, considering that most Government organizations follow prescribed policies quite diligently, the scope for finding a very wide variations across laboratories working under the same department may be quite low.

The second limitation of the study is that the number of departments included in the study were only four. Considering the size of our Government, and the size of R & D expenditure in the Government sector, only four Department may not be good representation of the shape of R & D in the entire institutional sector. However, as was shown in Chapter-1, most of the major expenditure of Government sector are channeled through only four or five departments. Naturally, policy and practice followed by these

departments will have a far-reaching impact on the career prospects of R & D professionals than all the other myriad of departments together.

The third limitation of the study is that the project did not include any study on career and reward aspiration and expectation of R & D professionals in these laboratories that participated in the study. It has been repeatedly shown that when human resource policies are in keeping with the aspiration and expectation of the employees, the impact of such policies on employee motivation are far more than when there is no relation at all. Thus a restructuring of reward system without understanding the inner desires and drives of the professionals, may not yield very fruitful results.

Scope for Further Study

One area which needs to be explored in future is a comprehensive analysis on the reward and career expectation of R & D professionals in India. This may cover both Government sector, public sector as well as the private sector R & D. Such a study may throw light on why different types of reward systems are used in different types of organisations and why some organizations are more successful than others in attracting, retaining and motivating professionals. There are some organizations whose investment in infrastructure are more suitable for very innovative product development while there are others whose infrastructure and resources strength are more suitable for commercialization of new products or adaptation of new technology or new products. The strategic orientation and job characteristics of the later laboratories are totally different from those of the former. People working in these different type of organizations will have different reward and career orientation. In order to encourage the professionals to work towards the specific strategic goal the reward system must be aligned well with the aspiration and expectations of the professionals working there. Thus a comprehensive study on reward and career expectation in different types of organizations in different sectors of the economy may help us redesign the reward system better.

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Appendix-A

(Copy of the letter written to the Head of the four laboratories)

Dr Pulak Das
Human Resource Group

Date: 25.4.97

Dear Sir,

With the opening of our economy and the increasingly aggressive posture of developed countries over the IPR issues, the role of scientific research and scientists are becoming more and more crucial. Our economy is entering an era of intense competition. Indian scientists hold the key to whether or not these challenges would be met successfully. We have the third largest pool of trained scientists and technologists of the world. It is only by using these resources in an innovative manner that we can meet those challenges.

There has been growing concern that possibly we have not done much in making the scientific research career an attractive one to our professionals leading to considerable frustration and turnover. This turnover is taking place both occupationally within the country as well as externally to other countries. In order to address to a few of these issues, the Department of Science and Technology, Government of India has sponsored a research study titled " **Restructuring of Research and Development Services in the Central Government: An Evaluation of Pay and Performance Reward System** " vide their letter no. FNO. DST/NSTMIS/05/06/96 dated 6.3.97 to us. **The objectives of this study are (1) to understand the nature and types of rewards that exist in our R & D laboratories and the frequency of their use; (2) to analyse the effectiveness of the existing performance appraisal system to identify and reward good performers; (3) to evaluate the effectiveness of the existing pay system to attract and retain the services of qualified and quality professionals; (4) to ascertain the nature and pattern of turnover of R & D professionals; (5) to estimate the level of competitiveness in career among professionals across organisations.**

This study would require comprehensive organisational file data on **pay, personal data and performance record of** scientists from different national laboratories. ..... is one of the premier centres of advanced scientific research. It employs not only some of the best talents of the country but is also engaged in research that has far reaching impact on nations progress and prosperity. In view of employment of large number of highly trained professionals and because of the importance of your research work in our technical progress, we have identified your organisation as one of the selected centres for undertaking the above study on the career of scientists. We hope you also share our concern and would extend all your support and co-operation to make the study a success.

The Department of Science and Technology desires that the results of this study are available to them in a year time. With the circumstances, may I request a meeting with you and your colleagues to explore the possibility of doing the study in your organisation.

As for the confidentiality of information supplied by you, I assure you that no individual or organisation would be identified in the report and all data and records provided would be used strictly in research. However, if you wish, a summary of finding of analysis from your organisation would be communicated to you for your internal use.

With kind regards.

Yours sincerely

(Pulak Das)

Appendix-B

(Copy of the Questionnaires used to collect additional information from two laboratories)

Dr Pulak Das
Human Resource Group

Sub: Questionnaire Survey for DST Sponsored Project

Dear Friends, Date: 15.10.97

With the opening of our economy and the increasingly aggressive posture of developed countries over the IPR issues, the role of scientific research and scientists are becoming more and more crucial. Our economy is entering an era of intense competition. Indian scientists hold the key to whether or not these challenges would be met successfully.

However, off late there has been growing concern that possibly we have not done much in making scientific research career adequately attractive and rewarding to pursue leading to considerable frustration and turnover both occupationally and externally to other countries. In today's world, no individual works in a airtight compartment detached from the social and economic environments. Events and career opportunities in other professions and occupations do affect the motivation and aspiration of scientists. Inspite of the important role played by our scientists in providing a competitive edge and in raising the nations image abroad, there has been few attempts to understand their career aspirations and to design a career that is both attractive and competitive with similar other occupations. I am sure you also share this view.

In order to address to a few of these issues, the Department of Science and Technology, Government of India has sponsored a research study titled " **Restructuring of Research and Development Services in the Central Government: An Evaluation of Pay and Performance Reward System** " vide their letter no. FNO. DST/NSTMIS/05/06/96 dated 6.3.97 to us.

As a part of the above research project, we are doing a career survey in five laboratories from five separate Departments of the Government. These Departments..... I request your co-operation and support to make the study a success. Without your active participation and interest the findings of this study will not be meaningful. With the circumstances, I request you to kindly take a little time and fill up the enclosed questionnaire and put in the envelope and return to your lab co-ordinator within a week. As for the confidentiality of the information. I can assure you that no individual or division will be identified anywhere in the report. Kindly sign the envelope across the seal.

Thank you.

Yours sincerely

(Pulak Das)

Reward Satisfaction Questionnaire

1. Name or Employee Code: Date:

2. Present Designation : 3. The year you joined this post:

4. Gender : Male/Female 5. Date of Birth :

6. Year of Joining the Organisation:

7. Educational Qualification (List the degrees you acquired after 12 or 11th standard):

8. What year did you acquire your Bachelors or Equivalent Degree?

9. Area of specialisation in last degree: Mechanical/ Civil/ Electrical/ Electronics/ Computer/ Chemical/ Aeronautical/ Other

10. Your present Basic Salary :

11. You had any work experience when you first joined in this lab. ? If so how many years.

12. Can you recall the grade at which you joined ?

13. Can you recall your **monthly gross and basic salary** when you joined ?
(Only if you joined within the last five years)

14. Do you remember your performance appraisal score of last year (Only Part-I of your appraisal form) ? If yes then kindly tick your last year score.

Outstanding/ Excellent/ Very Good/ Good/ Satisfactory/ Fair/ Poor

15. Are you heading any research project now ? If yes then

i. No. of members in the project. ii. Estimated cost of the project.

iii. Estimated time to complete the project.

16. Who initiated the above project ?: Self/ others

17. Have you taken any off-company training in last three years ? If yes then total how many days ? Include overseas travel periods also.

18. Kindly provide the dates (only month and year) at which you received your promotions in ---- since joining.

19. We are trying to understand your expectations on the type of reward that you look forward to from your organisation when you feel you have done a good work and your organisation also believes that you deserve a reward. Suppose one of your innovation suggestion and subsequent R & D effort (it can be in the form of new product or on a new process) has become a big commercial success and the country is expected to make a substantial saving by way of reduced

import. Your organisation has decided to reward you for this innovation. Only one reward is being considered. Some of the types of rewards they are considering are given below. Can you rank them from 1 to 7 based on what you feel is most wanted and what is least wanted form of reward. 1 corresponds to most wanted and 7 corresponds to least wanted form of reward. Please consider only your own desire and needs.

i. Some cash rewards immediately at the completion of the project in proportion to duration and cost of the project.

Rank:

ii. Accumulate points in proportion to size and significance of the project which can be used for promotion.

Rank:

iii. Accumulate points in proportion to size and significance of the project which can be used for annual pay growth.

Rank:

iv. Opportunity to take sabbatical leave to acquire new skill. **Rank:**

v. Opportunity to undertake bigger project in line with the organisational mission. **Rank:**

vi. Opportunity to undertake own research project which may not be directly connected with organisational immediate interest.

Rank:

vii. Increasing organisational responsibility to oversee and guide other research workers.

Rank:

20. Now suppose instead of one reward, your company decides to make a combination of two rewards, which are the two combinations that you would prefer most. Just indicate the combinations of reward numbers.

Appendix-C

General Characteristics of Current Manpower(Lab-A)

Table-A1

Distribution by educational qualification

Total	BE	ME	Ph.D
303	100 (33.3%)	101 (33.3%)	102 (33.4%)

( ) Percentage of Total

Table-A2

Distribution by age

Minimum Years	Maximum Years	Mean Years	Median Years
22.58	59.92	44.49	47.4

Table-A3

Distribution by age of entry

Type	Minimum	Maximum	Mean	Mode
Total	21.2	52.4	27.4	25(47)
BE	21.2	43.9	26.1	24(18)
ME	21.8	42.8	26.3	25(18)
Ph.D.	21.8	52.4	29.7	27(11)

( ) No. at the mode.

Table-A4

Distribution in Grades

Grades

Type	1	2	3	4	5	6
Total	48 (15.8%)	46 (15.2%)	58 (19.1%)	88 (29%)	58 (19.2%)	5 (1.7%)
BE	26	21	26	22	5	0
ME	21	18	18	31	13	0
Ph.D	10	7	14	35	40	5

( ) Percentage of Total

Table-A5

Distribution by work experience in the organisation

Type	Minimum	Maximum	Mean	Mode	Median
Total	0.25	36.7	17.1	24	19.8
BE	0.34	34.2	15.8	24	18.1
ME	0.25	32	16.1	6	17.8
Ph.D.	1.5	36.7	19.3	24	21.8

Table-A6

Distribution of monthly salary.

Type	Minimum	Maximum	Mean	Median
All	2200	7300	4536	4650
BE	2200	6300	3901	4075
ME	2200	6700	4271	4325
Ph.D.	2500	7300	5421	5400

Characteristics of Current Manpower (Lab-B)

Table-B1

Distribution by educational qualification

Total	BE	ME	Ph.D
203	98 (48.28%)	93 (45.81%)	12 (5.91%)

( ) Percentage of Total

Table-B2

Distribution by age

Minimum Years	Maximum Years	Mean Years	Median Years
27.49	59.83	44.12	45.83

Table-B3

Distribution by age of entry.

Type	Minimum	Maximum	Mean	Mode
Total	19.24	52.08	25.92	24(40)
BE	19.24	52.08	25.94	24(18)
ME	20.42	45.42	25.60	24(20)
Ph.D.	23.25	38.34	28.31	27(3)

( ) No. at the mode

Table-B4

Distribution in Grades

Type	Grades 1	2	3	4	5	6
Total	60 (29.6%)	70 (34.5%)	45 (22.1%)	22 (10.8%)	6 (2.96%)	---
BE	42 (42.9%)	34 (34.7%)	13 (13.3%)	7 (7.1%)	2 (2.0%)	
ME	17 (18.3%)	34 (36.6%)	26 (28%)	13 (14%)	3 (3.2%)	
Ph.D	1 (8.3%)	2 (16.7)	6 (50%)	2 (16.7%)	1 (8.3%)	

( ) Percentage of total

Table- B5

Distribution by work experience (in years) in the organisation

Type	Minimum	Maximum	Mean	Mode	Median
All	0.81	38.33	18.2	31.0 (16)	17.33
BE	0.83	38.33	18.64	31.0(10)	19.84
ME	1.33	31.49	17.85	10.0(13)	17.25
Ph.D	4.49	33.49	17.33	16.0(3)	15.83

Table-B6

Distribution of monthly salary.

Type	Minimum	Maximum	Mean	Median
All	3000	6900	4488.9	4500
BE	3000	6900	4318.6	4412.5
ME	3000	6900	4603	4650
Ph.D.	3500	6900	4995.8	4900

General Characteristics of Current Manpower (Lab-C)

Analysis done on 50% of the total sample of 1017 scientists data (Some data was deleted because of incomplete information).

Table-C1

Distribution by educational qualification

Total	BE	ME	Ph.D
490	316 (64.5%)	156 (31.8%)	18 (3.7%)

( ) Percentage of Total

Table-C2

Distribution by age

Minimum Years	Maximum Years	Mean Years	Median Years
23.33	59.5	41.56	40.4

Table-C3

Distribution by age of entry.

Type	Minimum	Maximum	Mean	Mode
Total	20.58	49.83	26.32	23 (92)
BE	20.58	49.83	26.51	24 (64)
ME	21.58	32.75	25.71	26 (29)
Ph.D.	23.75	37.33	29.19	27 (4)

( ) No. at the mode.

Table-C4
Distribution in Grades

Grades

Type	1	2	3	4	5	6	7
Total	53 (10.8%)	120 (24.5%)	127 (25.9%)	96 (19.6%)	76 (15.5%)	1	17 (3.5%)
BE	45	86	79	62	40	0	4
ME	8	34	47	28	29	1	9
Ph.D	0	0	1	6	7	0	4

Table- C5

Distribution by work experience in the organisation

Type	Minimum	Maximum	Mean	Mode	Median
Total	0	32	15.2	26 (45)	13.4
BE	0	32	14.4	26 (23)	12.7
ME	0	30.5	16.0	26 (16)	14.3
Ph.D	0	30.0	22.1	26 (6)	25.2

Table-C6

Distribution of monthly salary.

Type	Minimum	Maximum	Mean	Median
All	2120	8100	4386	3950
BE	2200	7900	4161	3825
ME	2120	8100	4623	4200
Ph.D.	4200	7700	6208	6250

General Characteristics of Current Manpower (Lab-D)

Table-D1

Distribution by educational qualification

Total	M.Sc	Diploma	M.Phil or M.Tech	Ph.D	Post Doctorate
618	58 (9.4%)	6 (0.97%)	12 (1.9%)	542 (87.7%)	7 (1%)

( ) Percentage of total.

Table-D2

Distribution by age

Minimum Years	Maximum Years	Mean Years	Median Years
29	61.4	51.4	52.9

Table-D3

Distribution by age of entry.

Type	Minimum	Maximum	Mean	Mode
Total	18.83	48.7	27.3	25 (67)
BE	18.83	39.25	26.2	27 (14)
ME	---	--	--	--
Ph.D.	20.0	48.67	27.41	25 (56)

( ) No. at the mode

Table-D4

Distribution in Grades

Grades

Type	1	2	3	4	5	6
Total	79	15	343	170	1	---
BE	21	6	38	7	0	--
ME	--	--	--	--	--	--
Ph.D	38	9	305	163	1	--

Table- D5

Distribution by work experience in the organisation

Type	Minimum	Maximum	Mean	Mode	Median
Total	4.16	37.5	24.1	14 (55)	26.0
BE	5.83	37.5	23.19	26 (9)	25.1
ME	--	--	--	--	--
Ph.D	4.16	37.5	24.27	29 (71)	26.1

Table-D6

Distribution of monthly salary.

Type	Minimum	Maximum	Mean	Median
All	2500	7600	5401	5250
BE	2500	6900	4960	550
ME	--	--	--	--
Ph.D.	2500	7600	5449	5250

Appendix-D

List of Members of the Local Project Advisory Committee

1. **Dr. H. S. Maiti,** Director (Acting),
   Central Glass and Ceramic Research Institute, Calcutta- 700 032

2. **Mr S. K. Ghosh,** Deputy Director,
   Central Glass and Ceramic Research Institute, Calcutta- 700 032

3. **Dr S. K. Mittal,** Director (R & D), Exide India Ltd,
   217, Nazrul Islam Avenue, P.O. Deshbandhu Nagar, Calcutta- 700 059

4. **Prof. Amitava Bagchi,** Professor, MIS Group, Indian Institute of Management
   Calcutta. P.O.Box. 16757, Calcutta- 700027

5. **Dr Laxman Prasad**, Head, NSTMIS Division, Department of Science &
   Technology, Technology Bhawan, New Mehrauli Road, New Delhi-110 016

6. **Dr G. J. Samathanam,**
   PSO, NSTMIS Division, Department of Science & Technology,
   Technology Bhawan, New Mehrauli Road, New Delhi-110 016

7. **Dr (Major) N. G. Kannan,**
   General Manager (Human Resource), Indian Oil Corporation Ltd.
   2, Gariahat Road (South), Calcutta- 700 068.

8. **Mr C. K. Khasnabis,**
   Head,Computer Division,Variable Energy Cyclotron Project
   Atomic Energy Commission, 1/AF, Bidhan Nagar, Calcutta- 700 064

9. **Mr. R. Banerjee,**
   General Manager(R & D), BOC India Ltd. (Technology Centre)
   48/1, Diamond Harbour Road, Calcutta- 700 027.

10. **Mr Aravind Chak,**
    Senior Manager (Technical Development), Dunlop India Ltd,
    62A, Mirza Ghalib Street, Calcutta- 700 016

Project team at Indian Institute of Management Calcutta

Prof. Pulak Kumar Das, Principal Investigator, Human Resource Group, I. I. M. Calcutta

Sri Amal Kumar Saha, Project Assistant, Research Pool, I. I. M. Calcutta.