CHAPTER I

INTRODUCTION TO THE THESIS

1.1 Introduction

Strategic management of R&D organizations has assumed importance in recent times. Information from studies on R&D and innovations management has had significant effects on the management practice. Hamel (1998) argues that in a discontinuous world, strategy innovation is the key to wealth creation. Strategy innovation is the capacity to re-conceive the existing industry model in ways that create new value for customers, wrong-foot competitors, and produce new wealth for all stakeholders. It stresses upon resource creation, vital for success in the face of resource disadvantages. Thus, unique resources could provide competitive advantage if they are non-tradable, non-imitable and non-substitutable. Among the strategic factors, R&D activity is considered one of the most important parts of maintaining a lead, especially in high-tech industries (Lee and Shim, 1995). Bowonder and Miyake (1997) have presented a case study of Canon Inc. in terms of its R&D and business strategy. According to Brockhoff et al. (1997), the problems identified in effectively organizing the R&D process fall into a number of major areas, for example, the duration of R&D projects, the explosion of total R&D costs and the loss of competitive edge. Also reflected are trends towards globalization of R&D projects, outsourcing of capabilities, the need to improve communication among R&D organizations and, ultimately, networking.

Chiesa and Manzini (1996) and Chiesa (1997) have focussed on different aspects of R&D management. Sushil (1997) has proposed a flexible systems management as an evolving paradigm. Balachandra and Friar (1997) have probed into the factors for success in R&D projects and new product innovation. Stainer and Nixon (1997) have looked into the issues of productivity and performance measures in R&D. Based on a survey of over 40 UK companies, Pearson et al. (1998) have presented a framework for implementing TQM in R&D which has a high strategic content. This thesis critically analyzes the development of a strategy initiative framework for technological innovation in the laboratories of Council of Scientific and Industrial Research (CSIR), India. It also studies the functioning of research councils and management councils and the functional deployment of scientific and technical (S&T) manpower, assesses the factors affecting motivation levels and work group satisfaction of scientists, develops a model for measuring the performance of research units, and investigates into the causal relationships among

the factors of work climate and measures of performance of these units, of the laboratories of CSIR.

1.2 Management of R&D Systems

In India, scientific and technological research is concentrated in industrial and government funded institutions like the Council of Scientific and Industrial Research (CSIR) where the demand for profit, growth and accountability respectively require that research activity is directed, at least in the long run and more often in the short run, towards the solution of practical problems. Further, it is directed primarily towards the general objectives of social and economic development and national security. These external tasks provide, to a great extent, the stimuli, growth and justification of scientific work. The traditional task of individual researcher to determine what scientific questions he wishes to pursue is being significantly affected by the requirements of funding agencies, as well as by the change in the R&D organizational structure. The scientist is no longer a free individual concerned solely with what he can find. Now he is concerned with what he ought to do (Taguire, 1965). There is a growing imperative of relevance. The demand is heard in every quarter: 'the church must be relevant, government must be relevant, business must be relevant and of course, scientific research must be relevant' (Connor, 1984).

It has been argued in recent years that the way in which scientific and technical knowledge is produced is changing quite radically (Gibbons et al., 1994). If there is a fundamental change in the mode of knowledge production, it is likely to lead to a reorientation of the R&D practices and organizations. If the changes are pervasive across fields of scientific and technical activity, they would affect the research and innovation systems. According to Gibbons, the key change is that scientific and technical knowledge production is becoming a less self-contained activity. In many leading-age areas of research, several different skills are required in order to solve problems.

The critical role of R&D management, therefore, cannot be underestimated. Maintaining credibility will require R&D managers to leverage internal R&D capabilities with external resources, deliver long-term as well as short-term value, facilitate rapid learning, and to focus on speed in the commercialization of new technology (Larson, 1996).

One of the more intriguing problems is how to direct research towards innovation. The European Union has also put its fingers on this aspect within its 'Green Paper on Innovation' (1996). It is intriguing and relevant because the optimization of the relationship between R&D and innovation allows organizations to reach competitive advantages through the increasing rate of successful innovations and (internally) through the rationalization of R&D activities (Chiaromonte, 1996).

There are few prescriptions for managing technological innovation. Bahrami (1992) has suggested that the management of innovation involves a dialectical process of synthesis between multiple dilemmas (e.g., freedom and control, flexibility and focus, differentiation and integration, incrementalism and discontinuity). While some theorists have begun to describe the complexities of organizational creativity and the innovation process (Woodman et al., 1993), there is still much that needs to be learnt (Lengnick-Hall, 1992). Due to the ambiguous, unique and inherently uncertain process of technological innovation, R&D units must be managed quite differently from the other work units where the work is more routine. There are very few systematic studies linking management practices to innovations for the entire R&D unit. Learning approach (Senge, 1990a, 1990b) has found to be crucial to the process of innovation in other studies (Van de ven and Polley, 1992). Greve's (1998) study uses learning theory to examine how performance feedback affects the probability of risky organizational changes that are consequential to an organization's performance. The theory predicts how decision-makers interpret organizational performance by comparing it with historical and social aspiration levels. Since organizational learning is driven by a recursive relation between performance and goals (Lant, 1992), it is important to establish exactly what fraction of the total information derived from previous experience is actually taken into account in the decision-making activity. Alkhafaji et al. (1998) address questions of integrating TQM, strategic management and business process re-engineering. Organizations that typically converge around a prevailing archetypic strategic orientation and inertia tend to bound the organizational change to that which is consistent with the archetype representing first order change (Fox-Wolfgramm, 1998).

Shukla (1997) looks at the Indian scenario since the economic reforms of early 1990's. He states that a knowledge-based organization aims at creating a new paradigm which is possible by developing competencies and capabilities. This requires a change in the mindset of people about the nature of the organization. The challenge, therefore, is to learn new ways of operation.

A review of Hughes productivity study (Ranftl, 1989) shows that skilled responsible management is one of the most important factors in achieving high productivity in technology-based organizations. The study identifies 25 factors that are most likely to cause counter-productivity within R&D organizations. Among these factors are ineffective planning, direction and control,poor internal communication, poor psychological work environment, insufficient attention to employee motivation, misemployment, ineffective structuring of assignments, ineffective customer interface, and ineffective engineering/production interface. Organizational culture within the R&D unit is a key driver of innovation (Judge et al., 1997). Another empirical study carried out by Harrison (1974) relates the perceived role performance of 95 scientists in three large research laboratories to the organic system of management conceived by Burns and Stalker

(1961). The results indicate that the more organic the system of management, the higher is the perceived role performance of the individual scientist.

The main task of R&D management, therefore, is the creation and improvement of technological potentials which are preserved in the aggregated knowledge of the organization.

1.3 CSIR and the Initiation of Strategy

Council of Scientific & Industrial Research (CSIR), an autonomous society under the Societies' Registration Act, 1860 was set up in 1942. Soon after Independence, scientific research was announced as a portfolio under the Prime Minister. Since then Prime Minister of India continues to be the ex-officio President of the CSIR. The various functions assigned to the Council are:

(a) The strengthening of the existing research institutions and the establishment of new ones as appropriate.
(b) The promotion, guidance and coordination of scientific and industrial research and financing of specific research schemes.
(c) The utilization of research for the development of industry.
(d) The establishment and award of research studentships and fellowships.
(e) The establishment, maintenance and management of laboratories, workshops, institutes and organizations for the promotion of scientific and industrial research.
(f) Collection and dissemination of information and the publication of scientific literature.

The Governing Body is the highest policy-making body of CSIR. The Director-General is its ex-officio chairman. The CSIR Headquarters at New Delhi coordinates the activities of the laboratories. The Council enters into bilateral agreements in the fields of pure as well as applied sciences with scientific organizations of various countries.

CSIR has, in its fold, forty two national laboratories and a number of field stations working in different fields of R&D spread all over the country. Each laboratory of CSIR, headed by the Director, has two Councils: Research Council (RC) that looks after its long-term and short-term R&D strategies, and Management Council (MC) that looks after its administrative functions.

From the early focus on the development of technologies for self-reliance and import substitution products, CSIR in the recent era, has made attempts to confront the threats of liberalization and globalization. A report entitled 'Creating an Enabling Environment for Commercialisation of CSIR Knowledgebase: A New Perspective' (Mashalkar, 1993) brings out the issue of

globalization discourse by pointing out the global emergence of an 'order' reflected in the 'gradual consolidation of a new technological and development paradigm, characterised by the predominance of production processes that are increasingly science-based and technology-intensive, as well as by a very high rate of technological change'. The terms of the Committee who has authored the report and of which R. A. Mashalker (who later became the Director General of CSIR as is still continuing) was the Chairman did not refer to the issue of globalization. However, it was wise on the part of the Committee to refer to the global order that confronts Indian industry and the CSIR today. It is important indeed to conceive, conceptualize, plan and act for such a positive sum game, in which a winner's strategy of pact-making and pact-breaking can be undertaken by the CSIR.

Finally, as mentioned in the report, over the past few years, international firms and research organizations from Japan, the EC, and the USA have begun an aggressive internationalization of R&D. However, to our knowledge, such strategies have not been studied in India. In the absence of which what strategy can we formulate? Developments in the international collaborative research (Mowery, 1992) suggest the strong emergence of collusion, directed at defining and creating technologically 'upstream' products, along with their marketing and manufacturing.

The charter of CSIR enshrines, among other directives, the industrial development of India and the development of need-based technologies. In order to understand the aspects of commercialization of CSIR's S&T generation, we are constrained to study the constituent blocks of CSIR, viz., its constituent laboratories. CSIR Laboratories have a large degree of freedom. The corporate character of CSIR is almost entirely built upon the performances and functioning of these laboratories. In view of the liberalization and opening up of the economy and the consequent globalization, the term 'commercial rupee' (earning by CSIR laboratories from non-governmental sources) is gaining in significance.

In the light of the above discussion and the thrust that the present Director General has given to restructure and reorient the activities of CSIR and its laboratories, it has become imperative to critically study the prevailing practices of R&D project management, examine the role of research councils and management councils, understand the functional deployment of scientific and technical manpower, assess the level of motivation of the scientists and their satisfaction with their work groups, develop a model for measurement of performance of research units, and to evaluate the causal relationships among these performance measures and the factors of work climate of these units, of the laboratories of CSIR.