



A Study on Challenges Faced in Technology Innovation in Outshine R&D Organisations: a Global Perspective

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ABSTRACT

Innovations have acquired a key-role in the growth and competition strategies of the firms. They are regarded as an essential tool to stimulate growth and enable firms to master the competition brought about by the forces of globalization. At the same time, innovations in today's "globalized" world are hardly feasible in isolation. Worldwide economic reforms and far-reaching technological advancements have brought to fore new economic powerhouses, such as China and India, which possess strong scientific capabilities. Products are marketed internationally which often necessitates adaptation to specific needs of targeted markets. All these developments are leading to the "globalization of innovation". Based on recent empirical studies conducted by the author in this field, this paper presents the challenges faced by outshine R & D industry, particularly Space Research industry, wherein the System Reliability and the Technological Innovation are the prime concern. The results from statistical analysis of the data indicates that in the outshine Space research industries are able to attain their position of excellence, in terms their better technological innovation, by proper handling of their resources in an optimal way. The study indicates that in the outshine organizations, the employees enjoy the freedom of time and resources to make their contributions towards the attainment of organizational goals, undergo reasonable amount of stress in task execution owing to time and resources constraints, learn new technologies and adapt them and exercise autonomy which enables self-expression and learning. This Study aims at understanding the Challenges faced in technology innovation in Outshine R&D organizations in global perspective. This paper further suggests for proper technology innovation with appropriate forecasting, design & transfer of technology in the outshine

KEYWORDS : Technology, Innovation, Resources and Management.

Introduction

In today's global economy, all the industries enjoy the advantage of opportunities and faces challenges of competition, making the firms to be under pressure so as to optimize their cost market so as to make their product cheaper and faster. This pressure has led firms to try to reduce their operational costs and achieve efficiency-gains by contracting out routine and standardized activities – the process called 'Outsourcing' to an external entity that usually enjoys cost advantages on account of specialization and/or geographic location. Outsourcing is generally defined as contracting-out of business processes which may also include associated information technology (IT) processes. Thus, the competitive advantage particularly for firms from developed, industrialized nations is increasingly – and almost compulsorily – innovation-driven, since they are often at a disadvantage to compete with low-cost producers from emerging markets. It is therefore natural when an overwhelming majority of business executives (over 80%) see innovations as a corner-stone of their growth and competition strategies. The increasing importance of innovations in firm's success, is also discussed by IBM in a study on "global innovation outlook.

Review of literature

To sustain the existence and growth, firms are to compete with each other, in this knowledge based world. The notion "Survival of the fittest" has undergone a change and 'Organizations that are change responsive' are proving to be more profitable both financially and non-financially. Outshine organizations are 'uniquely positioned to support the development of human capital, infrastructural and psychological capital, structural and social capital, diversity and creativity capital and cultural and rights based capital'. It is believed that the basic premise for an outshine Organization is to create "an internal environment that supports customer's needs and expectations" (Dorfman et al, 2004).

The customer referred includes both the external customer as well as the internal customer, i.e. the employee. The uncertainty at the stock markets and pressures in businesses make many people think that the only target is financial success, but off late organizations now want people to remember their contribution in the creation of a HPO. The attrition rates of the so called best in class companies are narrative of the fact that retaining the best of employees is a primary concern. Organization aspiring to excel should realize that 'Our assets walk out of the doors, tired mentally and physically. We must

make sure that they come back with a zest to work, the next morning'. A good compensation plan which has a good pay is no longer enough. People expect the organization to create a culture where in their efforts are valued and recognized. They wish to work in a culture where in they are involved, empowered, have opportunities for career advancements, skill development and a culture where in they can believe that they are making a difference.

As stated, of the most important resources available to an organization, it is only the human resource which can improve themselves and add value to the organization. It is argued by some that the external customer comes next only to the internal customer, i.e. the employee. 'You cannot treat your people poorly and expect them to treat your customers well'. Any organization, which realizes this, would strengthen itself and moves a step ahead to transform itself into a outshine organization with its successful management of technology and innovation.

Defining Management of Technology and Innovation

Technology can be defined as the practical implementation of learning and knowledge by individuals and organizations to aid human endeavor. Technology is the knowledge, products, processes, tools, and systems used in the creation of goods or in the provision of services.

Management of technology is defined as linking "engineering, science, and management disciplines to plan, develop, and implement technological capabilities to shape and accomplish the strategic and operational objectives of an organization." (NRCR 1987)

Or we can also say that the management of technology is the linking of different disciplines to plan, develop, implement, monitor, and control technological capabilities to shape and accomplish the strategic objectives of an organization. Innovation can be defined as "the process whereby new and improved products, processes, materials, and services are developed and transferred to a plant and/or market where they are appropriate".

Management of Innovation

With innovation defined, how do we manage it? Successful innovation management depends on the top management of the organization's willingness to commit the resources to allow individuals and

groups to recognize “newness” and respond accordingly. This commitment by the top management to innovation, in turn, requires their recognition of several realities.

These realities are as follows:

1. Management of technology encompasses the management of innovation.
2. It requires fostering an environment where innovative thought and work are encouraged.
3. It involves leading a firm from existing processes and products to something that is “better” and more valuable.
4. It is proactive and encourages creativity and risk taking.

Therefore, we define the management of innovation as a comprehensive approach to managerial problem solving and action based on an integrative problem-solving framework, and an understanding of the linkages among innovation streams, organizational teams, and organization evolution. It is about implementation - managing politics, control, and individual resistance to change. The manager is an architect/engineer, politician/ network builder, and artist/scientist.

Successful Management of Technology and Innovation

According to Margaret A. White et. al (2007), to manage technology and innovation successfully, a firm must be proactive rather than reactive. To promote proactive approaches, a firm should:

1. Design the clear technology leaders - individuals who champion change.
2. Know how the processes can work to help and to hinder the development of new technology.
3. Assess objectively where your firm is on the technology curve.
4. Assess the strengths and weaknesses of your personnel and your approach to the management of technology and innovation.
5. Set realistic priorities.
6. Develop excellent infrastructure to help find and take advantage of potential Opportunities.
7. Understand what the tasks are and how they are connected and disconnected.
8. Be systematic in your search and assessment processes, but review the system thoroughly to be sure it is still applicable.
9. Savor every victory and learn from every failure.
10. Be confident that once you have made a decision, it is a decision that will Move you in the right direction.

Globalization in innovative R&D industries

In view of the potential advantages of ‘off shore’ R&D, many multinational firms have established R&D centers abroad. The United Nations Conference on Trade and Development (UNCTAD) has documented the increasing internationalization of R&D and the role of emerging countries in the innovation process (UNCTAD, 2005a; 2005b; 2005c).

According to UNCTAD, multinational firms spent on an average 28% of their R&D budget outside their home country. European firms spent on an average 41%, American 24%, and Japanese 15% of their R&D budget abroad. Two-thirds of all respondents foresaw a further increase in this expenditure. More than half (57%) of surveyed multinationals already had “an R&D presence in China, India or Singapore”, and “Developing Asia is the most often mentioned location for further R&D expansion by firms”, reveals UNCTAD (2005b). The same survey showed China as the most preferred R&D destination for next five years, followed by the US and India in second and third positions respectively.

Domestic R&D expenditure in India and China increased substantially in recent years as both countries are undertaking concerted efforts to build cutting-edge scientific capabilities, OECD (2006). The EU counts India and China among “major R&D performing countries in the world” (INNO METRICS, 2006). According to OECD, China’s R&D expenditures surged from USD 17 billion in 1995 to USD 94 billion in 2004 in terms of purchasing power parity (PPP), registering an average growth of nearly 20% per annum. China was projected to become the second largest R&D investor worldwide by overtaking Japan in 2006 in PPP terms (Dyer, 2006; OECD, 2006). Also the trend shows

India’s R&D expenditures increased to USD 24 billion in PPP terms, growing by nearly 8% p.a. on an average, making it the 8th largest R&D investor worldwide. In real terms China spent USD 15.6 billion on R&D in 2002, India USD 3.7 billion in 2001, according to figures available with UNCTAD (2005c). And Space Research related R&D organizations should consider these into account while developing a innovative product in view of global commercial viability.

Indian Space Research Organization (ISRO) as an Innovative R&D Organization

When we are intending to study the challenges faced in technology innovation in outshining R&D organizations, that too globally, it is very much apt to conduct the survey in an environment like that of ISRO.

ISRO as an outshining R&D organization, has the responsibility of meeting the Communication, Remote Sensing, Navigation, Disaster Management needs of the country. Having satisfied fairly this mandate for the socio economic progress of the nation, ISRO is now venturing into the larger picture of investigating the origin of life, presence of Liquid in Moon, Mars and beyond for the cause of humankind.

ISRO has the mandate of the nation for developing heavy lifting launchers like GSLV Mk III, Unified Launch vehicle (6 tons payload) and reusable launch vehicles for cost reduction of payloads (satellites) in future with its innovative technology.

ISRO is also venturing into the commercialization aspects, like launching satellites of other countries thereby bringing in valuable foreign exchange for the nation’s wealth.

In a nation like India, when it comes to the development of new cutting edge technologies in propulsion, Satellite technologies and navigation with very little help from the Indian universities, ISRO on its own, with its dedicated manpower of Scientists& technologists and time proven organizational culture, does fundamental R&D and most of the times production is also carried out by ISRO as the technologies demand high reliability and accuracy.

With the number of launches going up together with the number of satellites on the increase, this organization is opting to outsource some of the non-R&D activities to remain and concentrate on its prime R & D work.

At present, ISRO has designed & developed its own precision transducers, Electro optical sensors, precision control components and modules with its technological development program and transferred many matured technologies to local industries for mutual benefit. Whenever the production process, fabrication technologies is frozen beyond doubt, ISRO has begun off load the production of such hardware and components to Indian Industries like Godrej, HAL, MTAR, Midhani and the like. Other medium and small scale industries in the geographical vicinity of the activities also contribute in a major way in meetings the production demands.

ISRO as an Organization, remains mainly as an organization of Space related Research & Development so that it continues to stand as an outshine R&D organization, enjoying competitive advantage, globally.

Objectives of the Study

- To study the influence of opinion of experts with different Gender and Experience on the challenges faced in innovative outshine R&D industries.
- To study the influence of Commercialization, Outsourcing of activities, Technology related Forecasting, Development & Transfer, Organizational Culture and the like, that poses challenges on innovative activities in Outshine R&D industries.

Research Methodology

This paper investigates the various aspects of organizational practices and values that support and contribute to face the challenges in outshine R&D organizations, especially in Space Research industries with high ended technology innovation. This paper also focuses on influence of organizational objective, culture, dynamics, and its technological strategy which pave the way for the organizational excellence. This study was conducted on the subject by obtaining response

for the questionnaire from a sample of 120 among the 'Opinion leaders' of various lead ISRO Centres, namely ISRO Propulsion Complex, Mahendragiri, Vikram Sarabhai Space Centre, Thiruvananthapuram, Sathish Dhawan Space Centre, Sriharikota (AP), Liquid Propulsion Systems Centre, Valiamala & Bangalore. These respondents are Executives, Design experts/Scientists and have expertise in the field of Rocket & satellite design and launch. During this study, a total number of 250 questionnaires were distributed and out of this 120 replies were obtained from the respondents. The respondents were asked to state their level of agreement on overall perception about the factors influencing technology innovation in outshining Space Research industry. Statistical tools like weighted Mean, ANOVA and t test are used to obtain results for the objectives of the study.

Hypotheses

- H₁ - There is no mean difference between gender of the respondents and their opinion on challenges faced in technology Innovation.
- H₂ - There is no mean difference between Experience of the respondents and their opinion on challenges faced in technology Innovation.

Statistical Analysis

The Level of Agreement corresponding to each Factor among the respondents is shown below Table - 1. Rank was provided in the base of weighted mean value. The highest weighted mean value factor got first rank.

TABLE - 1

S.No	Study Parameters	Opinions of respondents	Scale	No. of Respondents	Total Respondents	Weighted Mean	RANK
1	Adopt better production process/ methods	Strongly Agree	5	36	120	3.866667	2
		Agree	4	48			
		Neutral	3	23			
		Disagree	2	10			
		Strongly Disagree	1	3			
2	Necessary Technology Forecasting, development acquisition & transfer	Strongly Agree	5	38	120	3.816667	3
		Agree	4	42			
		Neutral	3	22			
		Disagree	2	16			
		Strongly Disagree	1	2			
3	Proper management of information & knowledge	Strongly Agree	5	29	120	3.558333	6
		Agree	4	41			
		Neutral	3	25			
		Disagree	2	18			
		Strongly Disagree	1	7			
4	Commercialize the products with it competitive advantage	Strongly Agree	5	38	120	4.058333	1
		Agree	4	51			
		Neutral	3	31			
		Disagree	2	0			
		Strongly Disagree	1	0			
5	Out-sourcing activities/ process	Strongly Agree	5	27	120	3.741667	5
		Agree	4	53			
		Neutral	3	22			
		Disagree	2	18			
		Strongly Disagree	1	0			

6	Organizational culture	Strongly Agree	5	32	120	3.775	4
		Agree	4	49			
		Neutral	3	23			
		Disagree	2	12			
		Strongly Disagree	1	4			

Null Hypothesis - 1

H₀ - There is no mean difference between gender of the respondents and their opinion on challenges faced in technology Innovation.

TABLE - 2

	Category	N	Mean	S.D	Calculated 't' value	Remarks at 5% level
Gender	Male	89	4.16	1.171	0.69	NS
	Female	31	3.93	1.817		

(At 5% level of significance the table value of 't' is 1.96, NS- Non Significant)

Result

From the above table-2, the calculated t value (0.69) less than the table value (1.96). It is inferred that there is no significant difference between gender of the respondents and their opinion on challenges faced in technology Innovation.

NULL HYPOTHESIS - 2

H₀ - There is no mean difference between Experience of the respondents and their opinion on challenges faced in technology Innovation.

TABLE - 3

Variable	Experience level	Mean	Sources of Variation	df = 2,117		Calculated 'F' value	Remarks at 5% level
				Sum of squares	Mean square		
Experience	15 - 20 years	3.82	Between	27.426	13.713	2.94	NS
	21-30 years	4.03					
	31 years & above	4.18					

(At 5% level of significance, for (2,117) df the table value of 'F' is 3.07)

Result

From the above table-3, the Calculated F value (2.94) less than the table value (3.07). It is inferred that there is no significant Mean difference between Experience of the respondents and their opinion on challenges faced in technology Innovation.

Summary of the Findings and Conclusion

The study indicated that considering the life cycle of the technology, Outshine Space related R&D Organizations (OSRO) are required to take timely steps to carryout 1. Commercialization of the products with it competitive advantage, 2. Adopt better production process/ methods, 3. Improve Organizational culture, 4. Necessary technology Forecasting, development, acquisition and transfer, 5. Outsourcing of activities/process, 6. Proper Management of information & knowledge, so as to cope up with the changing global technological dynamics and continue enjoying its Outshine position.

It was strongly felt that commercialization should be the integral part of the new product development in OSRO. Therefore, linking commercialization to new products development should be given more attention. To reduce their operational costs and achieve efficiency, gains by contracting out routine and standardized activities can be worked out, as the process called 'Outsourcing' to an external entity that usually enjoys cost advantages on account of specialization and/ or geographic location.

It is evident from the study that in the organizational culture of OSROs, which excel in technology innovation, the employees are treated in such a manner in which they feel empowered. At all the levels, employees do exercise autonomy which enables self-expression and learning with least stress. The autonomy which employees exercise at all levels makes them to nurture their innovative ideas, evaluate the current work practices and determine the best work practices that suits the task delegated to them. It was observed that change resistant employees hamper high performance as they tend to be self-productive and do not support innovation. It can be concluded that in an OSRO, there exists a culture which promotes employee satisfaction. With respect to freedom of contribution, employees at all levels enjoy the freedom of contribution and resources thereby enabling them to utilize these resources optimally and not just feasibly. This promotes employees to make better contributions towards attainment of organizational goals.

The study was not intended to be all-inclusive, but rather to create better understanding of the challenges to be faced by a R&D organization, especially a Space related one wherein high degree of specialization and reliability matter most to sustain its existence and supremacy with all its globally competitive advantage.

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