Industry-Institute Technology Management Practices: A Case Study

Soujanya S Shenoy
Research Scholar,
Department of Humanities and Management
Manipal Institute of Technology,
Manipal Academy of Higher Education
Manipal, India
bhamyss@yahoo.com

Dasharathraj K Shetty
Assistant Professor
Department of Humanities and Management
Manipal Institute of Technology,
Manipal Academy of Higher Education
Manipal, India
raja.shetty@manipal.edu

Dr. Lewlyn L R Rodrigues
Professor & Head,
Department of Humanities and Management
Manipal Institute of Technology,
Manipal Academy of Higher Education
Manipal, India
l.rodrigues@manipal.edu

Balakrishna S Maddodi
Professor
Department of Civil Engineering
Manipal Institute of Technology,
Manipal Academy of Higher Education
Manipal, India
bs.maddodi@manipal.edu

Farahnaz Golrooy Motlagh
Graduate Researcher
Ohio Center of Excellence in Knowledge Enabled Computing
Dept. of CSE, Wright State University
USA
farahgm@gmail.com

***Abstract*—This paper investigates the institute-industry technology management (TM) practices based on the five key dimensions of Gregory's Process-Based Model. The research methodology involves a case study approach, involving a questionnaire survey of 196 faculty members from engineering institutes and 31 professionals from leading printing industries. While Acquisition of knowledge has been the top priority dimension in institutes, selection of knowledge is the top priority dimension in industries. Selection of knowledge is the second leading dimension in institute whereas, protection of knowledge is the second priority dimension in the industries. Identification of knowledge is the least prioritized dimension both in institutes and industries. This revelation has led to the drawing of implications to the managers of both the sectors to enhance the TM practices.**

Keywords—Knowledge Assets, productivity, Efficiency, Quality.

I. INTRODUCTION

Technology has changed the boundaries of possibility. Research has shown that Technology Management (TM) can provide a competitive advantage in business [1]. The technology-driven market in today's business world demands effective linkage between science, engineering and management [2].

Danbark (1993) defined TM as "all management activities associated with the procurement of technology, with research, development, adaptation and accommodation of technologies in the enterprise and its exploitation for production of goods and service" [3]. TM deals with understanding and control of the impact of technology on all management functions. There is evidence through research that TM can facilitate cost reductions, quality improvements and innovations [4]. Ho & O'Sullivan (2018) have emphasized upon the need to develop a standardization framework to enhance the effectiveness of technology management [5]. Arciénaga et al., (2018) have found that TM is a tool to tackle uncertainty avoidance in organizations [6].

There are several streams of research in TM. A group of authors have focused on the study of the comparison of TM models from the traditional and digital model of business. Another group of authors have focused on the three aspects of technologically driven business organizations: marketing, product and workplace practices [7]. Hsu and Sabherwal (2011) have made attempts to establish linkages between TM and Knowledge Management [8]. While there are several models which speak about the process approach to TM Gre- gory's Model (Gregory, 1995) has been very widely used as a reference both in manufacturing and service sectors [9]. The processes are not predefined in this model, and it has to be explicitly identified to an organization. However, the model gives a broad 5 stage approach which is generic to most of the organizations.

Why Benchmark Engineering Institute with Industry?

A simple reason to benchmark engineering institute with industry is that of the very well-known fact that in the present era, education is a rapidly growing industry like any other sector. There are quite a good number of practices that are analogous in both these industries. There are in fact similarities as well as dissimilarities in these two industries. For instance, the industry is mainly production oriented while engineering education is service oriented, printing industries process raw materials while in engineering education students are processed, the printing industries deal with product innovations while the engineering institutes deal with process innovation. However, the most striking point is that in an education sector the student enters as the raw material, then undergoes processing as the customer, and leaves the education system as the product and then takes the role of the supplier. So, the use of an effective TM can provide an edge in the education system also as learning can be enhanced through modern technology [10].

II. Literature Review

Technology is a means of converting scientific ideas and conceptual designs into products and process realities. Technology is the application of knowledge, scientifically desired or otherwise to the creation or modification of things and processes. Technology is the primary enabler of economic growth in a highly competitive market [11]. It has surfaced as a critical resource of great significance for sustaining corporate profitability. Even the companies in emerging nations cannot remain hidden from the interdependent and competitive global market system and have to use technology as a crucial variable for durability and growth [12]. Leading companies like Canon and Honda are aware of the importance of technology management. TM supports the goals of any business [9]. The pursuit of new science and technology is researching the unknown whereas; TM is the application of known technical principles [13]. Technology is not only recognized as an asset but also as an essential constituent that influences all management disciplines [4].

Management of technology has now become a strategic tool, and invariably the fortune 500 companies consider the management of technology to be at the forefront of their business agenda [14]. Technological change has become an essential issue within technology-based enterprises, and it concerns about the evaluation, development, implementation and substitution of technologies [15].

TM problems may be made understandable and can be made operational and integrated into standard management exercises of any firm. TM may be seen as a flow through the business, just as the way in which operational information and materials flow.

III. Research Methodology

The specific requirements of a TM process model usually vary from industry to industry. However, Gregory's process-based model is very general and can be used as a reference model. It is in harmony with the current process thinking which helps in the integration of the technological considerations and the other functions within the business. Gregory's model has five dimensions:

1. Identification
2. Selection
3. Acquisition
4. Exploitation
5. Protection

The data was collected from 196 faculty members from three engineering institutes and 31 professionals from a leading printing industry through self-administered questionnaires to measure the effective performance rating of five key dimensions of TM. The sample selection was through random sampling technique. Data thus collected was processed through Microsoft Excel 2000 and SPSS software for statistical analysis and reliability analysis.

IV. Research Findings

The descriptive statistics of different TM dimensions has been tabulated in Table I. The difference in ranking the various dimensions of the industry and engineering institute has been clearly shown in Figure 1 and Figure 2. The reliability analysis is shown in Table II and Table III.

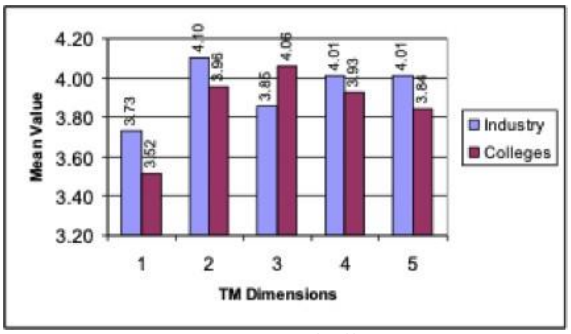

Fig. 1. Industry v/s Institutes comparison of different TM dimensions

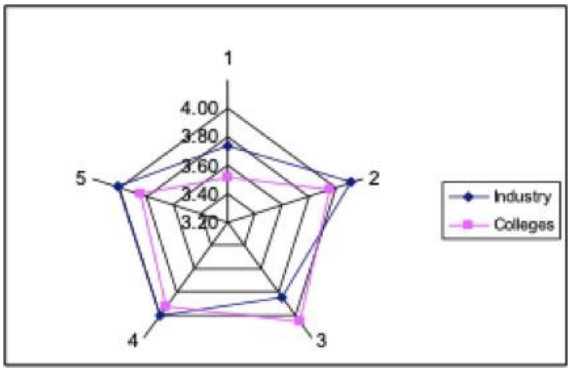

Fig. 2. Industry-Institute Gap Analysis

Reliability Coefficients No. of items = 5
Industry: No. of cases = 31.0 *Alpha = 0.7099*
Institute: No. of cases = 196.0 *Alpha = 0.6856*

V. Inferences Drawn through Statistical Analysis, Gap Analysis and Reliability Analysis

1. Dimension "identification," i.e. technology which can provide a competitive edge to the business is not well recognized by both the industry professionals and the academicians.
2. The industry has realized the relative importance of "selecting" the identified technologies as essential for their business, but academicians are not very aware of the right way of selecting technologies that can make the teaching-learning process very effective.
3. In dimension "acquisition" which involves conclusions about the relevant means of procuring specific technologies institutes are ahead of the industries. This is because a standard set of procedures have to be followed by the institutes for obtaining the required technologies, they have projects developed as prototypes of the latest technologies and teams to study advancements in science and technology. These aspects are to be strengthened in

the industry.

4. The industry realizes the importance of "exploitation," i.e. the aspect of using the latest technologies for production to obtain maximum returns but not by the institutes.
5. The industry is also well aware of the concept of "protecting" the knowledge and expertise embedded in these technologies. However, the legal routes for protection such as licensing and patenting are yet new to the institutions.
6. The reliability of the industry is 0.7099, and the institute is 0.6856, which delineates that the study has an acceptable level of internal consistency.

TABLE I. DESCRIPTIVE STATISTICS OF TM DIMENSIONS

TM Dimensions	Institute		Industry	
	Mean	Rank	Mean	Rank
Identification	3.52	5	3.73	4
Selection	3.96	2	4.10	1
Acquisition	4.08	1	3.85	3
Exploitation	3.93	3	4.01	2
Protection	3.84	4	4.01	2

TABLE II. RELIABILITY ANALYSIS — SCALE (ALPHA)

Dimension	Mean		Std. Deviation		Cases	
	Industry	Institute	Industry	Institute	Industry	Institute
Identification	3.7339	3.6549	0.4871	0.6446	31.0	196
Selection	4.1048	3.8750	0.5837	0.6994	31.0	196
Acquisition	3.8548	3.8380	0.5195	0.6240	31.0	196
Exploitation	4.0081	3.8856	0.5682	0.6157	31.0	196
Protection	4.0081	3.8632	0.5496	0.6429	31.0	196

TABLE III. ITEM WISE DESCRIPTIVE STATISTICS

Dimension	Scale mean if item deleted		Scale variance if item deleted		Corrected item- total correlation	Alpha if item deleted		
	Industry	Institute	Industry	Institute		Industry	Institute	Industry
Identification	15.9758	15.4618	2.6806	3.3617	**Identification**	15.9758	15.4618	2.6806
Selection	15.6048	15.2417	2.2532	3.0858	**Selection**	15.6048	15.2417	2.2532
Acquisition	15.8548	15.2787	2.1949	3.2177	**Acquisition**	15.8548	15.2787	2.1949
Exploitation	15.7016	15.2311	2.1726	3.0555	**Exploitation**	15.7016	15.2311	2.1726
Protection	15.7016	15.2535	2.3976	3.2234	**Protection**	15.7016	15.2535	2.3976

VI. RECOMMENDATIONS

1. It is essential to be updated with the advancements in technology which can be beneficial to the business. This can be achieved by creating a virtual research organization through extensive networking and alliances, and by conducting internal tests within the company.
2. A technology strategy should be developed to advise which areas of technology the industry can invest into.
3. A process-based strategy gives advantages in exercising technology management methods and making them more structured and lucid. These characteristics promote organizational learning at strategic and operational levels within the firm.
4. It is imperative to have a thorough process-based model to be precise about the motive for choosing the ap- propriate acquisition approach and the detailed methods needed to execute the preferred strategy.
5. Technology exploitation and technology fusion are increasingly essential to recover the high costs of investing in these technologies and social commitments. Exploitation can also help to drive new functionality through the integration of discrete technologies.
6. It is crucial to obtain or device mechanisms which can maintain critical technologies. These issues of protection are to be taken care during the design, development and acquisition stages.

VII. CONCLUSION

The purpose of this study is to benchmark TM practices in engineering institute with that in the industry and to make recommendations for quality enhancement. A survey was conducted based on the questionnaire which was used to collect data from faculty members of engineering institutes and professionals from the printing industry. Data collected was statistically analyzed for all the five dimensions of Gregory's process model. Further, Statistical analysis, GAP analysis and reliability analysis were carried out. The study revealed that the TM practices are better followed in the industry and the educational institutions still in the early stages of adoption. Also, the process of acquisition of the latest technologies in industries can be accelerated. TM has also emerged out as a survival tool, and industry and institutes may seriously consider its implementation, as competition is growing at a rate faster than ever before. The identified recommendations may have implemented to take achieve better performance.

REFERENCES

[1] C. Farrukh, R. Phaal, and D. Probert, "Technology management process assessment: a case study," *International Journal of Operations & Production Management*, vol. 21, no. 8, pp. 1116–1132, 2001.

[2] J. Chanaron and D. Jolly, "Technological management: expanding the perspective of management of technology," *Management Decision*, vol. 37, no. 8, pp. 613–621, 1999.

[3] D. Jolly, J. Chanaron, and K. Soderquist, "Technological management: a tentative research agenda," *International Journal of Technology Management*, vol. 23, no. 6, p. 618, 2002.

[4] J. Ho and E. O'Sullivan, "Standardisation framework to enable complex technological innovations: The case of photovoltaic technology," *Journal of Engineering and Technology Management*, vol. 50, pp. 0923–4748, 2018.

[5] A. A. Morales, J. Nielsen, H. Bacarini, S. Martinelli, S. Kofuji, and J. G. Díaz, "Technology and Innovation Management in Higher Educa- tion—Cases from Latin America and Europe," *Administrative Sciences*, vol. 8, no. 2, p. 11, 2018.

[6] N. Hair, L. Wetsch, C. Hull, V. Perotti, and Y. Hung, "Market Orientation in Digital Entrepreneurship: Advantages and Challenges in a Web 2.0 Networked World," *International Journal of Innovation and Technology Management*, vol. 9, no. 6, p. 1250045, 2012.

[7] C. Hull, Y. Hung, N. Hair, V. Perotti, and R. DeMartino, "Taking advantage of digital opportunities: a typology of digital entrepreneurship," *International Journal of Networking and Virtual Organisations*, vol. 4, no. 3, p. 290, 2007.

[8] I. Hsu and R. Sabherwal, "From Intellectual Capital to Firm Performance: The Mediating Role of Knowledge Management Capabilities," *IEEE Transactions on Engineering Management*, vol. 58, no. 4, pp. 626–642, 2011.

[9] M. Gregory, "Technology Management: A Process Approach," vol. 209, 1995, pp. 347–356.

[10] L. Stošić, ""The Importance of Educational Technology in Teaching", ijcrsee," pp. 111–114, 2015.

[11] K. Momaya, D. Banwet, and H. Shee, "Competitiveness through technology management: an empirical study of the Indian software industry," *International Journal of Services Technology and Management*, vol. 4, no. 2, p. 131, 2003.

[12] M. Sharif, "Technology strategy in developing countries: evolving from comparative to competitive advantage," *International Journal of Technology Management*, vol. 14, no. 234, p. 309, 1997.

[13] G. Gaynor, "Handbook of technology management." New York, N.Y: McGraw-Hill, 1996.

[14] T. Khalil and H. Ezzat, "Management of technology and responsive policies in a new economy," *International Journal of Technology Management*, vol. 32, no. 12, p. 88, 2005.

[15] H. Jung, "Technology management control: a conceptual approach for technology-based enterprises," *International Journal of Technology Intelligence and Planning*, vol. 1, no. 1, p. 115, 2004.