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Identification and evaluation of critical factors to technology transfer using AHP approach

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ABSTRACT

Technology Transfer (TT) process has been one of the most important activities in management of innovations in products, processes and services. It has been realized that critical factors (CFs) related to TT process need to be identified and evaluated. In this study, an attempt is made to analyze ranking of CFs of technology transfer. Twenty four CFs have been sorted by carrying out extensive review of literature and categorized in to five dimensions using experts' inputs. Analytical Hierarchy Process (AHP) methodology has been identified to be used for ranking of dimensions and CFs of technology transfer. All pair wise comparisons dealt with in AHP were made on the basis of opinions of experts. 'Regulatory concerns' has been prioritized as most important dimension of technology transfer. 'International bodies', 'Government authorities' and 'Environmental concerns' have been rated top three most important CFs based upon overall weight values of CFs. A conceptual model of interactions among these critical factors has also been presented which has further facilitated towards: proposing strategic framework; identifying practical and strategic implications; and deducing a strategic action plan for technology transfer process. This paper may help managers/practitioners to evaluate critical factors of technology transfer process towards achieving cost effective TT implementation and efficient management of resources.

1. Introduction

Technology transfer (TT) has increasingly been emerging as a recent and relevant topic of research among businesses, industries, nongovernmental firms, governments and of course academicians in last few years around the globe as well as in India. TT has also been identified as a very useful approach to gain competitive leverage over other firms/supply chains (SCs) [1]. Organizations may have various ways to explore their technological assets towards increased profitability and multi dimensional overall growth; however, internal exploitation of technological assets (through perceiving, planning, designing, developing, fabricating/manufacturing, and marketing/selling of products, processes and services) has been important, interests in exploitation through TT externally have intensified in recent years [2]. In developing country like India, TT may be one among possible solutions for improvement/growth of economic and industrial sectors; however, TT success may significantly depend upon appropriate choice of right technology from right source [3].

Technology transfer yet not received due consideration in policy development in most of countries undergoing the process of development [4-7].

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Technology transfer may be very helpful to provide implications for developing and less developed countries to solve technological, economic, environmental and social problems [8]. Moving innovative ideas from the research lab through production, marketing, and sales to the customer in a timely profitable manner has proven to be a difficult challenge even for the best managed business organizations. Therefore, it is crucial to recognize critical factors and develop theories for effective and efficient technology transfer [9].

Researchers need to: identify critical factors; conceptualize and understand theories and perspectives which may continue to influence TT implementation to relate and explain practical and empirical aspects of TT concept [10]. 'Critical factors', as a term initially used in the world of data analysis and business analysis, are key factors/enablers/activities essential towards success of any business/phenomenon to happen, which are required to be identified, evaluated and focused [11].

Hence, there has been a strong need to identify and evaluate critical factors of effective technology transfer process in Indian perspective. In that way, the objectives of the present research are as follows:

i. Identification of critical factors of effective technology transfer process;
ii. Evaluation of identified critical factors of effective technology transfer process in Indian perspective;
iii. Development of the conceptual strategic action plan for effective technology transfer process in Indian perspective

Literature review along with experts' opinions has been used to identify critical factors of effective technology transfer. Literature review has been found a valid approach and necessary step in appropriately structuring research field [12-13]. Further, AHP methodology has been identified appropriate to evaluate these critical factors because of the following reasons [14-21].

AHP is well established methodology that was developed by Saaty in 1977. It has been increasingly utilized to compare alternative solutions with reference to a criterion, in pair wise mode and resulting priorities may be utilized to compare and rank alternatives. Comparisons are based upon experts' opinions so may be found relevant for present scenario. The methodology checks for consistency using consistency index. The AHP technique is simple, systematic, scientific, dependable, and user friendly at the same time because of availability of suitable software to calculate priority matrices from comparison matrices.

Paper is organized as below: review of relevant literature is provided in Section 2. Critical factors of TT process are recognised through extensive literature review and provided in Section 3. Research framework and methodology used in the present research is explained in Section 4. Analysis of data and results are provided in Section 5. Discussions on findings are offered in Section 6. Important and noticeable implications of the research are suggested with strategic action plan for TT implementation (Section 7).Finally, and concluding remarks are presented with limitations and scope for future work.

2. Literature review

This section outlines the Technology Transfer (TT) process and major contributions in the field of TT and development of conceptual framework to understand TT performance. The details have been provided in the following sub sections.

2.1. Technology transfer

With the rapid advancement of technology, product life cycle is shortening continuously. In order to compete against other firms in fiercely competitive global markets, a business organization has to keep developing new technologies to differentiate it from competitors[22].Technology may be referred to a complex phenomenon comprising of know-how and techniques and may be recognized as a system of applied useful knowledge manifested or embodied in human beings and physical objects; and this transfer process from 'industrialized/developed countries' to yet 'developing ones' may not be possible without moving into formal agreements and following formal procedures [4]. Organizations have been adopting advance technologies to meet existing challenges towards new/better products, processes/activities, services and practices for delivering higher efficiency and effectiveness [19].Inter organizational technology transfer (ITT) is a key component of business organizations' innovation processes [23].

Technology transfer is one of the major challenges for the societies and business organizations in global economy. In fact, it is a complex process through which technology moves from outside sources to the organization/supply chain/country and complexity of this transfer process has been examined by growing number of researchers whose findings have been found useful in technology policy decision making [24].

2.2. Major contributions in TT

Al-Mabrouk and Soar (2009) analyzed major issues for successful information technology (IT) transfer in Arab countries. Findings suggested that the coding approach and synthesis procedures resulted in a master set of ten major issues categories for successful IT transfer [25]. Sung et al. (2009) identified factors influencing technology transfer and examined the role of these identified factors on success of technology transfer in Korean IT industry. Results reported that 'Concreteness of Technology' as the most influential factor for technology transfer [9]. Canto et al. (2012) explored critical factors that had an impact in successful transfer of manufacturing technology by taking data from 12 plants in the state of Yucatan, Mexico with corporate headquarters in the US and Italy [26]. Lee et al. (2010) explored the most critical factors of the technology transfer of equipment by taking a case example