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SMEs AND ACQUISITION OF NEW TECHNOLOGY

Mwamba T. Godfrey*

School of Business & Economics, Africa International University, Nairobi, Kenya

ABSTRACT

Generally, in most African countries SMEs are characterized by low technology levels, which are likely to as a hindrance in the emerging global market. Therefore, there is a need for SMEs to upgrade their technology in the process of producing goods and effectively compete in the emerging global market. SMEs will not be able to upgrade their technology and compete effectively in the emerging global market, without removing some specific barriers from the learning environment in which the employees will be learning how to use the new technology. This paper critically reviews the literature on common characteristics of manufacturing SMEs and barriers to the transfer of technology and learning in order to identify the challenges faced by SMEs after acquisition of new technology. This study has adapted a tested model from the researcher's previous work on developing a learning environment among semi-skilled workers. A PhD. Thesis submitted to the University of Delhi (2005). The purpose of this paper is to provide a framework that will enable SMEs owners/managers and HR consultants to conduct a proper learning needs analysis, identify challenges that are likely to act as barriers to the transfer of technology and learning process among employees in SMEs on one hand and on the other, provide effective ways of removing barriers so that employees may be able to learn how to use new technology effectively and enable SMEs to compete in the emerging global market. On the basis of critical review of previous research work, the findings of the present study suggests that training is the main determinant of transfer of technology, in the process of technology transfer, the emphasis is on the acquisition of knowledge. Some challenges (lack of time and money, high turnover of staff; negative attitudes towards external intervention; negative attitudes of SMEs managers and owners towards learning and informal learning is more common and preferred in SMEs) that are likely to as barriers to the transfer of technology and learning process among employees and managers/owners in SMEs originating from cultural aspects of the learning environment in the organizations. The best ways to remove barriers include: design training programs based on properly identified learning needs to change the attitudes of managers/owners regarding education and training and to acquire management skills that will enable them to effectively formulate and implement technology transfer strategy effectively.

Key words: *transfer of technology, learning environment, acquisition of knowledge, attitudes of SMEs managers and owners and employees in SMEs*

* Corresponding author email: godfrey.mwamba@africaInternational.edu

Introduction

Generally, in most African countries SMEs are characterized by low technology levels, which are likely to as a hindrance in the emerging global market. Therefore, there is a need for SMEs to upgrade their technology in the process of producing goods and effectively compete in the emerging global market. SMEs will not be able to upgrade their technology and compete effectively in the emerging global market, without removing some specific barriers from various aspects of the learning environment in which the employees will be learning how to use the new technology. The acquisition of new technology creates new learning needs which must be met through different training programs.

Every effort should be made to make such training facilities available for MSEs' entrepreneurs through workshops and seminars (Phyllis, Paul,&Mungania, 2013).

Technology transfer can be defined as a process of planned, selective, focalized importation of advanced technology which the enterprise has not nor did not master, and new application of imported technology which can bring expectant economic benefits to new users (Hung and Tang, 2008as cited in Subrahmanya,2014). What is more important is the transfer of information and skills to the employees of the technology receiving firm, which constitutes the second step. The second step is more important because if the technology acquiring firm has to effectively use the transferred technology, acquisition of necessary information and skills related to the use of the new technology is essential and crucial (Subrahmanya, 2014).

However, technology transfer activities in SMEs are being severely hampered by a lack of proper understanding of such technology transfer issues and their interrelationships to both company capabilities and processes, and the knowledge characteristics of the technologies being transferred (Sexton, &Barrett, 2004). Therefore, the process of technology transfer is very complicated and requires skills and managerial know how of the acquiring firm. New skills and managerial know-how will enable SMEs to have strategic direction and capability, inter-organizational networks and the knowledge characteristics of technology (appropriately focused and integrated to achieve a specific aim). In the African context, training has been found to be the main determinant of transfer of technology (Phyllis, Paul,&Mungania, 2013). However, the results of research works on SMEs, indicated that there are challenges that are likely to act as significant barriers to effective learning, the emphasis is on the acquisition of knowledge (Sedoglavich, 2012). This paper provides a framework that will enable SMEs managers and owners and HR consultants to conduct a proper learning needs analysis, identify challenges that are likely to as barriers to the learning process among employees in SMEs on one hand and on the other, provide effective ways of removing barriers so that employees may be able to learn how to use new technology effectively and enable SMEs to compete in the emerging global market.

Literature Review

*New learning needs and challenges among SMEs***.**

Manufacturing SMES around the world are being affected profoundly by emerging technologies resulting in a significant increase in competition in local, regional and global markets. To meet these challenges, SMEs will require new technologies, and systems that will enable them to enhance their manufacturing capabilities (Subrahmanya, 2014).Technology transfer involves the whole process where knowledge related to

the transfer of inputs into outputs is acquired, its effective management is increasingly associated with continuously acquiring and mobilizing knowledge and technological advances. Success depends on creating new knowledge and on having the capabilities to react quickly and effectively to changes in the environment, and to respond to new opportunities promptly. In the process of technology transfer, the emphasis is on the acquisition of knowledge (Sedoglavich, 2012) and also the study conducted by Phylliset al. (2013) concluded that the level of education and training is the main determinant of transfer of technology. The review of literature conducted by McBeath& Ball (2012), suggests that lack of skills or education can also create obstacles in the ability of the receiver to absorb technical know-how and during a technical transfer, the receiving site's poor programming experience and knowledge of the project resulted in significant delays in the transfer. Sexton& Barrett (2004) argued that technology transfer will only be effective if all three elements – strategic direction and capability, inter-organizational networks and the knowledge characteristics of technology – are appropriately focused and integrated to achieve a specific aim. However, some challenges (lack of time and money, high turnover of staff; negative attitudes towards external intervention; negative attitudes of SMEs managers and owners towards learning and informal learning is more common and preferred in SMEs were identified in the review of literature conducted by Alonderienė (2010). These are likely to act as barriers to the transfer of learning in SMEs. The finding of the research study conducted by Padachi &Bhiwajee (2016), in Mauritius, indicated that there is absence of a formal training process among SMEs. Mostly, SMEs indulged in informal, on-the-job training with little or no systematic approach being adopted, leave alone a proper training needs analysis. In the previous studies conducted in the USA, Australia, New Zealand, England, and Scotland, the results revealed that informal learning is more common and preferred in SMEs (adapted from Alonderienė, 2010).

Technology Acquisition

According to Hemmert (2004 as cited in Subrahmanya, 2014), technology acquisition performance of firms is influenced by a variety of institutional factors which include access to R&D personnel, access to external sources of knowledge (firms and research institutions), administrative environment and the organization of knowledge transfer. However, Fulton&Hon (2010) in their study identified several new challenges to SMEs. These include selection of the appropriate technology and system, implementation with its associated cost, training and staff acceptance, and mentoring from the system supplier to give advice on best practise.

General characteristics of SMEs

There is no official or universally accepted definition of an SME. The definitions used vary widely among countries, but are usually based on employment. In general, an SME is considered to have fewer than 500 employees, although many countries use a lower cut-off, say 300 or even 100. The OECD (Organization for Economic Co-operation and Development) makes the following distinction: micro companies (one to four employees), very small companies (five to 19 employees), small companies (20-99 employees) and medium-sized companies (100-500 employees). The EU defines SMEs as having fewer than 250 employees (Drawn from The Scottish Office StatisticalBulletin Index 1998 by Lange et al. 2000).

Among firms of different sizes, SMEs have unique constraints in managing to achieve technology development for their

growth. SME entrepreneurs have relatively poor ability to manage technology as a strategic weapon, deliberate actions to improve the technological base of the firm are seldom taken; they have limited human resources and weak financial standing. All these are constraints for SMEs to achieve technology development internally (Subrahmanya, 2014).

The life-cycle and problems facing manufacturing enterprises across stages of development.

Previous research shows considerable support for the life-cycle model of organizations and that problems facing organizations differ across stages of development. While there is some indication that HRM activities differ across stages (Rutherford, Buller, and McMullen. 2003). Evidence suggests the following characteristics at different stages of development of manufacturing enterprises:

Small enterprises

In small enterprises there is little formal training. Technological learning takes place by doing, using and interaction. Tight cultural environment, and little social distance, communication is quick and efficient. New employee typically gain procedural knowledge of organizational system by pairing up with experienced employees in their area to learn the way things are done.

Medium enterprises

In medium enterprises, the amount of attention given to the development of human resource is significantly higher in this stage as compared to the small enterprises. A team approach to work design is typically adopted during this stage and training (learning) takes the form of both on and off-the-job.

Large enterprises

In large enterprises have reached maturity stage, new functions are added in response to problems that arises during the growth stage. Indeed the organization structure takes the form of bureaucracy, with compartmentalization based on specialized function (e.g., human resources, quality control, and employee training) formal policies and procedures in place, employees are empowered to increase customer satisfaction, reward are structured around team performance, and participative management is at its highest level (Ciavarella 2003; D'Costa 1998).

SME owners/managers

The review of literature conducted by Smith & Barrett (2016) on small business owner-managers (SBOMs) identified the following challenges that are likely to act barriers to learning transfer:

First, participation in formal programs is not seen as a priority by SBOMs as they have limited time and find it difficult to attend training, with few, if any employees to cover their absence.

Second, SBOMs often see training as a cost not an investment. Third, SBOMs prefer informal learning, they prefer to seek help, information and support from others, thus much learning occurs outside formal program. Langeet al. (2000), in their study on SMEs and barriers to skills development: a Scottish perspective sub-divided barrier to skills development into four simplified categories:

Firstly, ``cultural" barriers which include primarily attitudes towards skills development.

Secondly, financial barriers which refer to those barriers directly relating to the cost or perceived cost of training and learning. Thirdly, access and provision barriers, referring to problems which either prevent interested parties from accessing skills development opportunities or manifest themselves in the lack of suitable provision of learning. Fourthly, awareness barriers which relate to the knowledge of

learning opportunities. They carried out an investigation of the barriers to skills development among SMEs. Their analysis revealed the influence of the prevalent SME culture to be significant. Other barriers that are identified refer to awareness, finance, access and provision. The effects of these factors on employee participation in skills development are marked. They stated that cultural barriers are one of the greatest hurdles affecting small business attitudes towards training and skills development. The culture within a small firm differs greatly from that in larger organizations. The way business is conducted and the way in which the firm is managed thus drive the culture of a firm (Lange et al. 2000). However, a crucial aspect of culture is that of the personality and experience of SME owners/managers. Against this background, they presented the following motivating factors which create a specific SME training and learning environment which were identified by Federation for Small Businesses: In the majority of small businesses, it is the owner of the business who either does the training or is directly responsible for the training of the employees. The level of competency of employees in small firms tends to be directly related to the competency of the owner. The owners of smaller businesses often resent employees who know more about new technologies and systems than they do. Resentment of high skills/knowledge is considerably reduced if the person who has those skills/knowledges is a close member of his/her family. Businesses which are operated by highly trained, educated individuals or by people who have a high personal opinion of their own business abilities are much more likely to have employees who have higher levels of skill than the owner may possess (Lange et al. 2000). Kenya's MSEs are characterized by restricted levels of technology, inappropriate technology and inadequate institutional capacities to support adaptation (Phylliset al. 2013).

The management in the smaller firm is primarily an adaptive process concerned with adjusting a limited amount of resources usually, in order to gain the maximum immediate and short-term advantage. In the small firm efforts are concentrated not on predicting but on reacting to the operating environment, adapting as quickly as possible to the changing demands of that environment and devising suitable tactics for mitigating the consequences of any changes which occur (Beaver and Jennings 2005).

Learning among SMEs

The review of literature conducted by Alonderienė (2010), the following identified challenges such as lack of time and money, high turnover of staff, selection peculiarities – SMEs tend to hire skilled employees instead of training unskilled ones, negative attitudes towards external intervention, and negative attitudes of SMEs managers and owners towards learning.

Acquisition of new technology among SMEs.

In the process of technology transfer, the emphasis is on the acquisition of knowledge, where intellectual property protection plays a vital role. Technology transfer is not the same as exporting goods. Transfer takes place through various channels and mechanisms including licensing, franchising, subcontracting, JVs, co-operative research arrangements, sale of turnkey plants, exchange of scientific and technical personnel, science and technology conferences, trade shows, etc. After analysing the data, the synthesized (Sedoglavich, 2012).Once a suitable technology has been imported, a process of adaptation of this technology should take place to absorb it efficiently and an appropriate institutional framework to fulfil specific institutional formulation,

development, financing, training and infrastructure (Phyllis et al.2013).

SMEs are reluctant to adapt to new technologies not only because of the financial investment involved but also due to a lack of confidence in their ability to acquire and successfully deploy the knowledge required (Thomas et al., 2008 as cited in Fulton & Hon, 2010)

SMEs are wary of investment in a service that can be viewed as upfront consultancy fees, indeed the very existence of support packages can often enhance the SMEs opinion that the knowledge required to implement the system is beyond their capabilities. Without mentoring and support, companies and their employees are often reluctant to adapt even if they are aware that they must evolve in order to survive. This reluctance can have devastating results in an SME especially given the current manufacturing climate (Fulton & Hon, 2010).

Sexton & Barrett (2004) has pointed the following key issues from the literature:

Performance improvement based on technology absorbed into small firms through technology transfer does occur successfully. However, firms need to understand and manage technology transfer activity to ensure consistent success. From the review of literature conducted by McBeath & Ball(2012), the present study identified barriers to the transfer of technology such as lack of skills or education can also create obstacles in the ability of the receiver to absorb technical know-how, during a technical transfer, the receiving site's poor programming experience and knowledge of the project resulted in significant delays in the transfer, novices can experience some difficulties in the transfer process due to the low absorptive and retentive capacities, a large knowledge gap, and cultural and communication difficulties.

McBeath& Ball (2012) proposed a framework that depicts the essential criteria and stages required for the successful transfer of technical know-how to a new facility. The four key stages propose the ideal conditions for accomplishing the transfer of technical intellect. Firstly, the foundation is good communication, strong leadership and relationship building. Selecting the correct people to lead the transfer is critical. The next phase is the qualification of explicit data, through the detailed review of controlling documents and the creation of an exhaustive and thorough standard for all the operations to be transferred. This phase is followed by the capture of all the tacit knowledge ("know-why") by intensive on the job training.

Finally, the verification stage which ensures, through audits, examination and process capability, that the know-how and know-why of all the processes has been transferred successfully. Overarching the whole structure is the workforce interaction of both the transmitting and receiving sites' personnel. Without this vital component of the framework, the transfer of intellect and knowledge would not be fulfilled. These different but equally important phases make up the proposed framework for the transfer of technical intellect.

The role of networks in the process of technology transfer

Inter-organizational networks promote and facilitate the development and transfer of knowledge and resources needed to encourage learning and innovation in participating firms. Knowledge characteristics of technology – the extent to which new technology can be effectively absorbed by small firms is substantially influenced by the characteristics of the technology being transferred. The argument is that technology transfer will only be effective if all three elements – strategic direction

and capability, inter-organizational networks and the knowledge characteristics of technology – are appropriately focused and integrated to achieve a specific aim (Adapted from Sexton, M. &Barrett, P. 2004).

Carlson (1990), in his study on the sister industry program in Tanzania and the Zambian alternative that the concept of network had never been really applied in the analysis of the working of agency development projects. A network perspective views projects as systems of actors related to each other. An actor can be a single individual, group or organizations, dependent of each other and having to co-operate but with no formal authority or hierarchy.

A new feature was the involvement of the National Bank of Commerce in the funding of the equipment. This extended transfer of technology was by the Tanzanian junior sisters. In most cases they utilize the similar technology, the products are not the same and they can be complementary. There was also a benefit to the junior sisters in the software and training fees for service rendered. There is no doubt that this model has been successful so far. Technology transferred has been well mastered.

Problem of Research

In most African countries, SMEs are characterized by low technology levels, which are likely to as a hindrance in the emerging global market. Therefore, there is a need for SMEs to upgrade their technology in the process of producing goods and effectively compete in the emerging global market. The acquisition of new technology creates new learning needs which must be met through different training programs. In the previous studies, training has been found to be the main determinant of transfer of technology (Phyllis et al.2013). However, the results of research work on SMEs, indicated that there are challenges (lack of time and money, high turnover of staff; negative attitudes towards external intervention; negative attitudes of SMEs managers and owners towards learning and informal learning is more common and preferred in SMEs) that are likely to act as significant barriers to effective learning. Therefore, there is a need to provide a framework that will enable SMEs managers and owners and HR consultants to conduct a proper learning needs analysis, identify challenges that are likely to as barriers to the learning process among employees in SMEs on one hand and on the other, provide effective ways of removing barriers so that employees may be able to learn how to use new technology effectively and enable SMEs to compete in the emerging global market.

Research Focus

The process of technology transfer is very complicated and requires skills and managerial know-how of the acquiring firm. Technology transfer in developing countries is facing challenges, there is still significant dependence on external/foreign assistance for management and skilled operations, the technology buyer remains entirely dependent on suppliers from overseas. Difficulties such as breakdowns, delays in delivery of spare parts, and repairs that have to be dealt with by foreign experts located abroad, lead to long delays in production schedules (Rahman & Bennett, 2009). Technology transfer involves the whole process where knowledge related to the transfer of inputs into outputs is acquired, its effective management is increasingly associated with continuously acquiring and mobilizing knowledge and technological advances. Success depends on creating new knowledge and on having the capabilities to react quickly and effectively to changes in the environment, and to respond to new opportunities promptly. In the process of technology transfer, the

emphasis is on the acquisition of knowledge (Sedoglavich, 2012).

The review of literature conducted by McBeath& Ball (2012), suggests that lack of skills or education can also create obstacles in the ability of the receiver to absorb technical know-how and during a technical transfer, the receiving site's poor programming experience and knowledge of the project resulted in significant delays in the transfer. Sexton& Barrett(2004) argued that technology transfer will only be effective if all three elements – strategic direction and capability, inter-organizational networks and the knowledge characteristics of technology – are appropriately focused and integrated to achieve a specific aim. However, some challenges (lack of time and money, high turnover of staff; negative attitudes towards external intervention; negative attitudes of SMEs managers and owners towards learning and informal learning is more common and preferred in SMEs) were identified in the review of literature conducted by Alonderienė (2010) which are likely to act as barriers to the transfer of learning in SMEs. The finding of the research study conducted by Padachi & Bhiwajee(2016), in Mauritius, indicated that there is absence of a formal training process among SMEs. Mostly, SMEs indulged in informal, on-the-job training with little or no systematic approach being adopted, leave alone a proper training needs analysis.

General Background of Research

The process of technology transfer is very complicated and requires skills and managerial know-how of the acquiring firm and also reported on technology transfer in developing countries challenges in developing countries, mentioning that there is still significant dependence on external/foreign assistance for management and skilled operations is still significant and that the technology buyer remains entirely dependent on suppliers from overseas. Difficulties such as breakdowns, delays in delivery of spare parts, and repairs that have to be dealt with by foreign experts located abroad, lead to long delays in production schedules (Rahman & Bennett, 2009). This is because technology transfer activities in SMEs are being severely hampered by a lack of proper understanding of such technology transfer issues and their interrelationships to both company capabilities and processes, and the knowledge characteristics of the technologies being transferred (Sexton & Barrett, 2004).

The acquisition of new technology creates new learning needs which must be met through different training programs. In the previous studies, training has been found to be the main determinant of transfer of technology (Phyllis et al.2013).However, the results of .research works on SMEs, indicated that there are challenges (lack of time and money, high turnover of staff; negative attitudes towards external intervention; negative attitudes of SMEs managers and owners towards learning and informal learning is more common and preferred in SMEs) that are likely to act as significant barriers to effective transfer of technology and learning. Therefore, there is a need to provide a framework that will enable SMEs managers and owners and HR consultants to conduct a proper learning needs analysis, identify challenges that are likely to as barriers to the learning process among employees in SMEs on one hand and on the other, provide effective ways of removing barriers so that employees may be able to learn how to use new technology effectively and enable SMEs to compete in the emerging global market.

Materials and Methods

This paper critically reviews the literature on SMES, the process of acquisition of new technology and effective transfer of technology in order to identify the main

barriers to transfer of technology and learning and recommend ways to overcome them. In the light of the above literature and identification of research gaps, the present study has the following research objectives:

Firstly, to determine the global challenges faced by SMEs after acquisition of new technology that are likely to act as barriers to effective use of new technology.

Secondly, to provide an effective, tested and approved model that will help SMEs in the process of removing barriers so that employees may be able to learn and transfer the new technology effectively on-the-job.

The above objectives are studied with reference to common characteristics of manufacturing SMEs in Africa, India, Europe, Australia and USA.

This research paper was guided by the following research questions:

Firstly, what are the challenges faced by SMEs after acquisition of new technology that are likely to act as barriers to effective use of new technology?

Secondly, what is the effective, tested and approved model that will help SMEs in the process of removing barriers so that employees may be able to learn and transfer the new technology effectively on-the-job?

The tested and approved model.

The present study suggests an effective, tested and approved model. This model is adapted from the researcher's previous work on developing a learning environment among semi-skilled workers. A PhD. Thesis submitted to the University of Delhi.

The methods and data analysis of the previous work on developing a learning environment among semi-skilled workers are presented below:

Sample of Research

Sample used in the process of testing adapted model in the previous study conducted by the researcher on developing learning environment among semi-skilled workers working in manufacturing enterprises in India (National Capital Region).

The population of the present study consisted of semi-skilled workers working in manufacturing enterprises in India (National Capital Region). The sample of 206 semi-skilled workers was drawn from 14 Indian manufacturing enterprises. The researcher used systematic sampling techniques (Nachmias and Nachmias 1996) in order to get the 10 per cent of semi-skilled workers' population from each of the above manufacturing enterprises. This study was based on the classification system which is used by the department of trade in the United Kingdom, according to which a micro enterprise has up to 9 people, small enterprise: 10-99, medium: 100-499, and large: 500 people and above (Harrison 2000).

Instrument and Procedures

Pilot Study

Being a preliminary piece of research (Whitley 1996), the pilot study was conducted as a final test of research procedures prior to beginning data collection. Therefore, it gave the researcher, an opportunity to understand that some semi-skilled workers in India were not literate even after completing primary education. Therefore, they struggled in reading the questionnaire which was translated into Hindi.

Reliability test.

Since the key figure in interpreting the reliability of our scale is the alpha, the

value of coefficient alpha can range from zero (no internal consistency) to one (complete internal consistency) an acceptable level of internal consistency is suggested to be a value of no less than.70 (Nachmias and Nachmias 1996). The value of Alpha for the questionnaire was found to be 0.87.

Content validity

The instrument was found to be accurately representing the concepts under study by university professors and HR managers of different manufacturing enterprises.

Construct validity test

In order to validate the theory behind the test (Kerlinger 1973; Levin 1978) KMO and Bartlett's Test of Sphericity was conducted for each and every group of manufacturing enterprise giving the following results in Chi-Square which were all found at acceptable levels for a two- tailed test with $\propto$ =.05 after comparing them with the tabulated values of the Chi-Square. The results were as follows:

Construct Validity Test

	Sample size	**Chi-Square value**
Metal enterprises in India	71	38.48
Rubber enterprises in India	81	40.36
Textile enterprise in India	51	34.82

Statistical treatment of data

The researcher used the following statistical tools for analysing data of the present study with the help of statistical package for social sciences (Babbie, Earl & Halley, Fred 1998):

Firstly, correlation analysis was used in order to study relationships among variables of the study (Levin & Rubin 1996).Secondly, Chi-square was used while conducting construct validity test (Levin & Rubin 1996; Keller and Warrack 1991). Thirdly, Analysis of variance (ANOVA) was used, to determine whether significant differences would be exhibited across classifications of components of learning needs, social, psychological, cultural and physical aspects of the learning environment organization-wise and demographic variables (Levin & Rubin 2002).

The researcher used stepwise multiple

Data Analysis

Correlation among variables in India

	1	2	3	4	5	6	7	8	9	10	11
Learning needs(1)	1.000										
Social Aspects(2)	.438**	1.000									
Psychological Aspects(3)	.365**	.436**	1.000								
Cultural Aspects(4)	.360**	.400**	.316**	1.000							
On-the-job Aspects(5)	.140*	.104	.316**	.011	1.000						
Off-the-job Aspects(6)	.173	.338*	.026	.070	.152	1.000					
Gender(7)	.161*	.062	.074	.110	.014	.008	1.000				
Age groups(8)	-.081	-.135	.005	-.026	.083	.058	-.234**	1.000			
Marital status(9)	.159*	.026	-.019	.036	.008	-.154	.238**	-.260**	1.000		
Educational levels(10)	-.010	-.095	-.010	-.104	-.001	.214	-.005	-.041	-.045	1.000	
Tenure(11)	.010	-.033	-.052	.006	.068	.006	-.088	.237**	-.135	-.053	1.000

** Correlation is significant at the 0.01 level (2-tailed).

* Correlation is significant at the 0.05 level (2-tailed).

An examination of the correlation matrix in the above table shows that learning needs have been associated positively and significantly with "Social aspects" (r =.438, p<0.01); "Psychological aspects" (r =.365, p<0.01);

"Cultural aspects" (r =.360, p<0.01); and "On-the-job physical aspects"(r =.140,

p<0.05). However, learning needs have not been found to be significantly associated with "Off-the-job physical aspects". This seems to reveal that the perception of learning needs among semi-skilled workers influences their perception of barriers to the learning process originating from social, psychological, cultural and physical aspects of the learning environment in India. Gender (r = .161, p<0.05) and marital status (r =.159, p<0.05) have been associated positively and significantly with learning needs among other demographic variables in India.

Predictor of the learning needs

Model	Predictors/Variables entered	Beta	T	R Square	R Square Change	F Change
1	Gender	.302	2.216*	.091	.091	4.912*
2	Social aspects	.314	2.380*	.187	.096	5.663*
*** p < 0.05**						

The above table shows that social aspects came out as the first most important predictor of the learning need. It explained 9.6 % in the dependent variable. Both the t-test (2.380) and F ratio (5.663) have shown significance of the coefficients of regression and determination respectively to be at 0.05 level. Similarly, the second key variable known as gender contributed 9% in dependent variable. Both the t-test (2.216) and F ratio (4.912) have shown significance of the coefficients of regression and determination respectively to be at 0.05 level. All in all about 19% of the overall variance in learning needs has been explained by the interaction of two independents variables (social aspects and gender). The analysis of the data revealed that the perceived learning needs in India could not be fully met because of significant barriers to the learning process originating mainly from social aspects of the learning environment.

In the above tested model, learning needs have been associated positively and significantly with Social aspects, Psychological aspects, Cultural aspects and On-the-job physical aspects. However, the perception of learning needs influences the perception of barriers to the learning process originating from social, psychological, cultural and physical aspects of the learning environment. Therefore, the learning needs or the need for technology transfer cannot fully be met until the barriers to the learning process originating from social, psychological, cultural and physical aspects of the learning environment are removed

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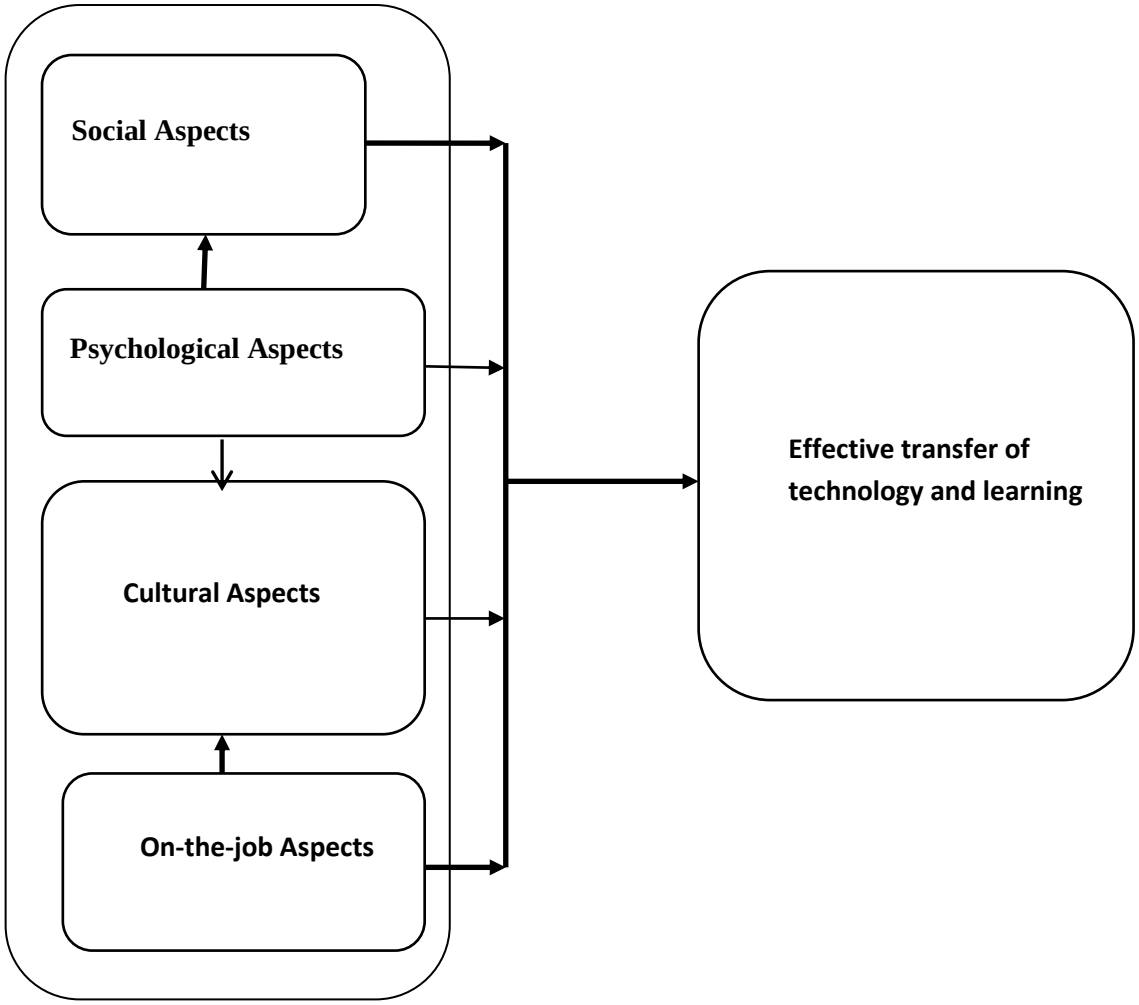
CONCEPTUAL FRAMEWORK

Independent Variables

Dependent Variable



Given that the acquisition of new technology creates new learning needs which must be met through different training programs (Phylliset al. 2013).This model suggests three important steps:

Step one, deals with the identification of learning needs which are created by the acquisition of new technology.

Step two, deals with identification and removal of barriers to the learning process originating from social, psychological, cultural and physical aspects of the learning environment.

In step three, an appropriate training is designed and conducted.

On the basis of the adapted model, effective transfer of technology and learning requires that all the barriers should be removed. Therefore, effective transfer of technology and learning is a dependent variable and is depending on the removal of cultural, social, physical and psychological barriers of the learning

environment. The following challenges were identified in the present study among SMEs through critical review of literature:

Firstly, lack of skills or education can also create obstacles in the ability of the receiver to absorb technical know-how and during a technical transfer, the receiving site's poor programming experience and knowledge of the project resulted in significant delays in the transfer.

Secondly, lack of time and money, high turnover of staff; negative attitudes towards external intervention; negative attitudes of SMEs managers and owners towards learning and informal learning is more common and preferred in SMEs

Thirdly, the absence of a formal training process among SMEs. Mostly, SMEs indulged in informal, on-the-job training with little or no systematic approach being adopted, leave alone a proper training needs analysis.

Fourthly, informal learning is more common and preferred in SMEs.

Fifthly, technology transfer activities in small firms are being severely hampered by a lack of proper understanding of such technology transfer issues and their interrelationships to both company capabilities and processes, and the knowledge characteristics of the technologies being transferred.

Sixthly, technology transfer mechanisms are not sufficiently informed by, or engaged with, company strategic direction and organizational capabilities and processes necessary to enable them to absorb technologies and to turn them into in a number of fluctuating inter-organizational networks of varying complexity.

In the present study, on the basis of critical review of literature, acquisition of new technology creates new learning needs among employees and managers in the manufacturing SMES. However, barriers to the transfer and learning process originating from cultural, social, physical and psychological aspects of the learning environment to hinder effective transfer of technology and learning.

This model is adapted from the researcher's previous work on developing a learning environment among semi-skilled workers. The following are the effective ways of removing barriers so that employees may be able to learn and transfer the new technology effectively on-the-job.

Suggestions

The present study offers the following suggestions in order to remove barriers from the process of transfer of learning and technology:

Firstly, in terms of social aspects, the introduction of team learning, the use of collaborative learning environments, encouragement of helping behaviors and social support from co-workers and supervisors. Trainers should treat employees with respect and dignity.

Secondly, in terms of psychological aspects, dialogue should be promoted among employees. The supervisor should act as coach, helping them to develop by giving them the opportunity to perform an increasing range of tasks and by helping them to learn from their experiences. Skill-based pay plan is the best solution as it helps meet the need of ambitious employees who confront minimal advancement opportunities. A formal training about workplace ethics should be given in order to help the organization identify legal and ethical issues.

Thirdly, in terms of cultural aspects in favor of manager owners, training programs based on properly identified learning needs to change the attitudes of managers/owners regarding education and training and to acquire management skills

that will enable them to effectively formulate and implement technology transfer strategy effectively. The association of manufacturers, small business owners and chamber of commerce can play a new role by using a consultant or university lecturers.

Fourthly, in terms of cultural aspects in favor of employees, the introduction of a culture that promotes supervisory support in problem solving, a learning climate that primarily encourages experimentation allowing mistakes because not all new ideas will work, a culture that promotes acceptance of languages other than their mother tongue, the replacement of the rule of traditional hierarchical control by a democratic approach in which subordinates are encouraged to express themselves fully and offer creative, innovative solutions to work-related problems and issues.

Fifthly, in terms of physical aspects, the permitted noise level of 75 decibels must be maintained by reducing noise from the source, the reduction of smoke from the source, the provision of larger space among employees at their workplace and the provision of normal temperature at the workplace and the provision of comfortable seating arrangement in the off-the-job learning environment.

Conclusion

On the basis of critical review of previous research work, the findings of the present study suggest that training is the main determinant of transfer of technology, in the process of technology transfer, the emphasis is on the acquisition of knowledge. Some challenges (lack of time and money, high turnover of staff; negative attitudes towards external intervention; negative attitudes of SMEs managers and owners towards learning and informal learning is more common and preferred in SMEs) are likely to as barriers to the transfer of technology and learning process among employees and managers/owners in SMEs originating from cultural aspects of the learning environment in the organizations.

The best ways to remove barriers include: design training programs based on properly identified learning needs to change the attitudes of managers/owners regarding education and training and to acquire management skills that will enable them to effectively formulate and implement technology transfer strategy effectively.

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