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INFORMATION TECHNOLOGY: FEASIBILITY OF ADOPTION AND IMPLEMENTATION IN SMALL SCALE INDUSTRIES IN INDIA

Prabhudatt Dwivedi* and G. P. Sahu**

ABSTRACT

In this paper empirical study is done to know the feasibility of adoption and implementation of information technology in small scale industries in India. Small scale industries have significant role in Indian economy in view of its contribution to production, employment and export. In the year 2003-2004 there were 11.39 million small scale industries in India contributing 39.42% in total industrial production and 6.71 % in Gross Domestic Product (GDP) (Ministry of SSI, Government of India, Annual Report, 2004-05). Small scale industries provide employment to about 27.14 million persons and contribute 35% of the total export form India (Ministry of SSI, Government of India, Annual Report, 2004-05). But, since 1991 small scale industries in India find themselves in very competitive environment due to the globalization. There can be many factors which influence the growth of small scale industries in India. Literature study reveals that out of many factors which influences the growth of small scale industries information technology is a significant one.

Introduction

Small scale industries are those manufacturing organizations where investment in plant and machinery is more than Rs. 25 Lakh but does not exceed Rs. 5 crore and those service organizations where investment in equipment is more than Rs.10 lakh but does not exceed Rs. 2 crore. (Micro, Small and Medium Enterprise Development Act, 2006, The Gazette of India).The development of Small Scale Industries (SSI) has been one of the major plank's of India's economic development (Bala Subrahmanyam, 2005). Small-scale industries have significant role in Indian economy in view of its contribution to production, employment and export. In the year 2003-2004 there were 11.39 million small scale industries in India contributing 39.42% in total industrial production and 6.71 % in Gross Domestic Product (GDP) (Annual Report, Ministry of SSI, 2004-05). Small scale industry provide employment to about 27.14 million persons and contribute 35% of the total export form India (Annual Report, Ministry of SSI, 2004-05).However, since 1991 small-scale industries in India find themselves in an intensely competitive environment due to globalization, domestic economic liberalization and dilution of sector specific protective measures (Bala Subrahmanyam, 2005). The formation of World Trade Organization in 1995 also forced the member countries (including India) to drastically scale down the restrictions on import. Due to the increased competitive force in the globalize market place it is important for a small business to know their customers, have open lines of

* KIET School of Management, Krishna Institute of Engineering and Technology, Ghaziabad. Phone: +91-9999870380, E mail: prabhudatt_d@yahoo.co.in

** School of Management Studies, Motilal Nehru National Institute of Technology, Allahabad. Phone: +91-9305508002, E mail: gsahu@mnnit.ac.in

communication, provide quality service and offer competitive price to maintain market share (Lee and Maniam, 2007). A technologically vibrant, internationally competitive SSI sector should be encouraged to emerge, to make a sustainable contribution to national income (Bala Subrahmanyam, 2005).The various literatures in the area of small scale industries are classified in two categories. These categories are on the basis of the similarity of the research area. The first one explains about the performance of small scale industries in India. Study is done about the growth of the small scale industries in India. In the second category the role of information technology in the growth of small scale industries is studied. Research papers in different context are studied to know the role of information technology in the small scale industries.

Performance of Small Scale Industries in India

The overall performance and contribution of SSI to Indian economy is generally described in terms of its absolute growth in units, employment, production and export (Bala Subrahmanyam, 2005).The growth of SSI in terms of units, employment, output and exports has come down (Bala Subrahmanyam, 2005).Small scale industries in India are facing extremely competitive environment after the liberalization (Gupta and Bewa, 2005). Innovative strategy is required for the further revival of small scale industries in India (Bhardwaj and Makkar, 2005). SSI need to identify their core strength to get the competitive advantage (Butt, 2005).For the growth, the small scale industries should be aware about the policies of the government (Narayana, 2006). It is suggested that the technology support is essential for the growth of small scale industries (Romijn, 2001).Performance of small scale industries as explained by the different researchers is given in Table 1.

Table 1: Performances of small scale industries

Author	Objective	User Context	Conclusion
Bala Subrahmanyam,et.al (2005)	Performance and prospects of SSI after globalisation	Study is done from secondary data from different sources	Growth of SSI has come down since 1991
Gupta and Bawa (2006)	Study of growth performance of SSI	Study is done in Punjab.	SSI are facing competition after liberalisation
Bhardwaj and Makkar, (2005)	Revival of SSI in post liberalisation scenario	Study is done in North-West belt of India	Model is proposed for the revival of SSI
Bala Subrahmanyam, (2004)	Technology innovations in SSI	Case study of two foundries in Karnataka	Innovation is required for the survival of SSI
Nagesha and Balachandra, (2006)	Barriers to energy efficiency	AHP technique is used for prioritization	Barriers to energy efficiency are prioritized
Butt, (2005)	Value chain management in SSI	Study is done from secondary data of different source	Competitive advantage are to be identified by SSI
Narayana, (2006)	Policies and programmes among SSI in India	Study is done for the SSI of Karnataka	Awareness about the policies is required for the SSI
Chaudhary,et.al (2000)	Role of organised sectors in developing SSI	Case study method is followed	Organised sectors have significant role in developing SSI
Romijn, H (2001),	Technology Support for SSI	Study is done for the developing countries	Technology support is essential for the growth of SSI in developing countries

Small Scale Industries and Information Technology

Information Technology has a vital role in the growth of small scale industries. Literature study is done to know the role of information technology in the growth of small scale industries (Table 2). Earlier research reveals that the adoption of information technology increases the efficiency of the organization. E-business have great potential for facilitating business transaction between small and medium size firms (Jeon et. al., 2006). Adoption of Information and Communication Technology (ICT) increases the efficiency of the organization (Ritches and Brindley, 2005). Role of Information Technology in the growth of SSI is studied in different context which is given in Table 2.

Table 2: Role of information technology in small scale industries.

Author	Objective	User Context	Conclusion
Beheshti, 2004	Study of impact of IT on SMEs	Study was done for the SMEs of United States	IT can be used to create competitive opportunities for the organizations.
Grandon and Mykytyn, 2004	To study the adoption of e-commerce in SMEs	Study was done in Chili	The nature of e-commerce adoption and diffusion by SMEs in developing countries is an important area of study.
Jeon et. al.,2006	Determining factors for the successful adoption of e- business by SME	Study was done in Korea using survey data.	e-business have great potential for facilitating business transaction between small and medium size firms.
Ritches and Brindley (2005)	Significance of information and communication technology in the growth of SMEs.	Study was done in context to Australian SMEs.	Adoption of Information and Communication Technology (ICT) increases the efficiency of the organization

Literature study reveals that Small Scale Industries have vital role in the growth of Indian economy. However the performance of small scale industries has come down in last few years. Information Technology is a significant factor influencing the growth of small scale industries. Researchers of many countries have suggested the adoption and implementation of information technology by the small scale industries increases the performance.

Study Design

The study is designed with an objective to identify factors that determine acceptance or lead to rejection of information technology by the small scale industries and to arrive at a model of information technology acceptance by the small scale industries. Based on the previous models these factors are identified and are given in table 3. These factors are further supported by the literature and given in table 4. A research model is designed which incorporates these variables. The research model for this study is illustrated in Figure 1. On the basis of the model the hierarchy of the variable is made using the Interpretive Structural Modeling (ISM).

Table 3: Models and theories for adoption of Information Technology in Small scale industries

Sl. No.	Models	Variables	Definition
1	SBIT Adoption Model (Syeal and Rehman, 2003)	(i) Relative Advantage	It measures the degree to which an innovation is perceived as better than its precursor.
		(ii) Social Expectation	It is the internal pressures and expectations in small business environment.
		(iii) Firm's Innovativeness	It measures, how frequently the innovation is occurring in the firm.
2	Normative Research Model (Lee and runge, 2001)	(i)Management Attributes	It is the top management attitude and the management support for the adoption of IT.
		(ii) Organisational Attributes	It is the variety of organizational factors that are critical facilitators to innovation adoption.
		(iii) Adoption Attributes	It is how potential user perception of information technology innovation influences its adoption.

Sl. No.	Models	Variables	Definition
3	Small Business IT infusion (Winston and Dologite, 1999)	(i) Organizational Structure	The factors in this category include structural attributes of the organisation and organizational IT experience.
		(ii) End User experience	The factors in this category include characteristics of the end user such as experience, training, involvement and incentive.
		(iii) Owner	The factors in this category include the characteristics of the business owner such as knowledge, strategy and involvement.
		(iv) Extra Organizational situation	The factors in this category explore the dependence of small business on consultants and strategic alliance to help infuse IT.

Table 4: Summary of variables

Sl. No.	Variables	Supporting Studies
1	Relative Advantage	Khazanchi (2005); Seyal and Rahman (2003).
2	Social Expectation	Syeal and Rehman, 2003 Khazanchi (2005)
3	Firm's Innovativeness	Syeal and Rehman, 2003 Jeon et.al. (2006),
4	Management Attributes	Lee and runge, 2001; Jeon et.al.(2006); Chahal and Kohali (2006); Seyal and Rahman (2003);
5	Organizational Attributes	Lee and runge, 2001; Winston and Dologite, 1999
6	Adoption Attributes	Lee and runge, 2001 Levenburg and Klein (2006);
7	End User experience	Winston and Dologite, 1999
8	Owner knowledge	Winston and Dologite, 1999 Ihlstrom and Nilsson (2003); Seyal and Rahman (2003); Wymer and Regan (2005).
9	Extra organizational situation	Winston and Dologite, 1999
10	Government Support	Jeon et.al. (2006), Wymer and Regan (2005).)
11	Financial Resource	Levenburg and Klein (2006); Khazanchi (2005)

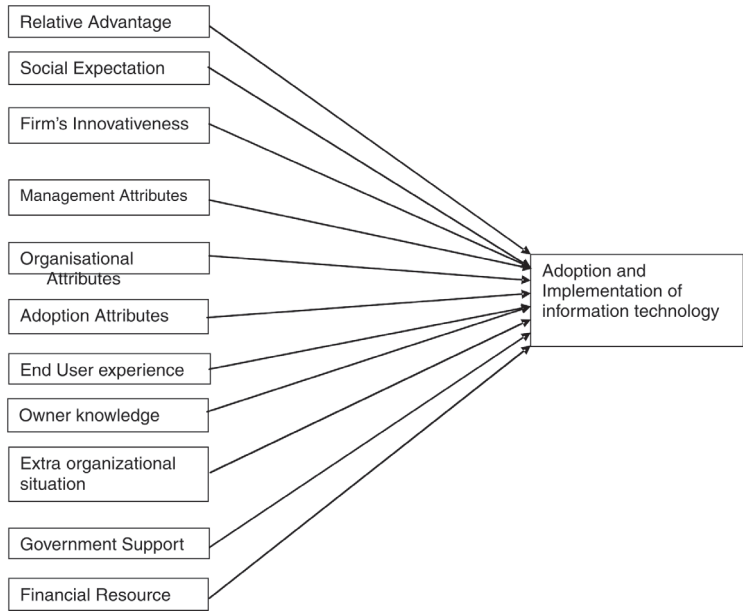

Figure 1: Model for the adoption of information technology in small scale industries

Data Analysis

On the basis of the model developed for the adoption and implementation of information technology the hierarchy of the variables is determined. Interpretive Structural Modeling is used to determine the hierarchy of the variables. In this process the Structural Self Interaction Matrix (SSIM) is prepared and then Reachability Matrix is created. From Reachability Matrix the hierarchies of the variables are formed. Finally the level of the variables is formed.

Structural Self-Interaction Matrix (SSIM)

Personal interview is conducted of the two experts; one is academician and the other entrepreneurship consultant. It is asked them to establish the relationship between the various factors as follows:

A, if i is predictor of j
B, if j is predictor of i
C, if i and j predict each other
D, if no predict each other

On the basis of their response the Structural Self-Interaction Matrix (SSIM) is prepared which is given in Table 5.

Table 5: Structural Self-Interaction Matrix (SSIM)

Elements		11	10	9	8	7	6	5	4	3	2
1	Relative Advantage	A	A	A	D	D	B	A	A	A	A
2	Social Expectation	A	A	A	A	D	A	A	A	D	
3	Firm's Innovativeness	D	D	D	D	D	D	A	D		
4	Management Attributes	A	B	D	A	D	A	A			
5	Organizational Attributes	A	D	A	A	D	A				
6	Adoption Attributes	B	D	D	A	D					
7	End User experience	B	A	A	A						
8	Owner knowledge	A	D	D							
9	Extra organizational situation	B	D								
10	Government Support	D									
11	Financial Resource										

Reachability Matrix

On the basis of the information in Structural Self-Interaction Matrix (SSIM) given in table 5 reachability matrix is formed. The responses of SSIM are converted in the binary form and thus the reachability matrix is formed, which is given in table 6.

Table 6: Reachability Matrix

Elements		1	2	3	4	5	6	7	8	9	10	11
1	Relative Advantage	1	1	1	1	1	0	0	0	1	1	1
2	Social Expectation	0	1	0	1	1	1	0	1	1	1	1
3	Firm's Innovativeness	0	0	1	0	1	0	0	0	0	0	0
4	Management Attributes	0	0	0	1	1	1	0	1	0	0	1

5	Organizational Attributes	0	0	0	0	1	1	0	1	1	0	1
6	Adoption Attributes	1	0	0	0	0	1	0	1	0	0	0
7	End User experience	0	0	0	0	0	0	1	1	1	1	0
8	Owner knowledge	0	0	0	0	0	0	0	1	0	0	1
9	Extra Organizational situation	0	0	0	0	0	0	0	0	1	0	0
10	Government Support	0	0	0	1	0	1	0	0	0	1	0
11	Financial Resource	0	0	0	0	0	0	1	0	1	0	1

Formation of Variables Hierarchy

For each variable the reachability set, antecend set and intersection set is determined. Then on the basis of the intersection of reachability set and intersection set the levels of the variables are determined (Table 7). This level of variables is shown in figure 2.

Table 7: Levels of variables

Variable	Reachability Set	Antecend Set	Intersection Set	Level
1	1,2,3,4,5,9,10,11	1,6	1	VII
2	2,4,5,6,8,9,10,11	1,2	2	VI
3	3,5	1,3	3	II
4	4,5,6,8,11	1,2,4,10	4	IV
5	5,6,8,9,11	1,2,3,4,5	5	III
6	1,6,8	2,4,5,6,10	6	III
7	7,8,9,10	7,11	7	III
8	8,11	2,4,5,6,7,8	8	II
9	9	1,2,5,7,9,11	9	I
10	4,6,10	1,2,7,10	10	V
11	7,9,11	1,2,4,5,8,11	11	II

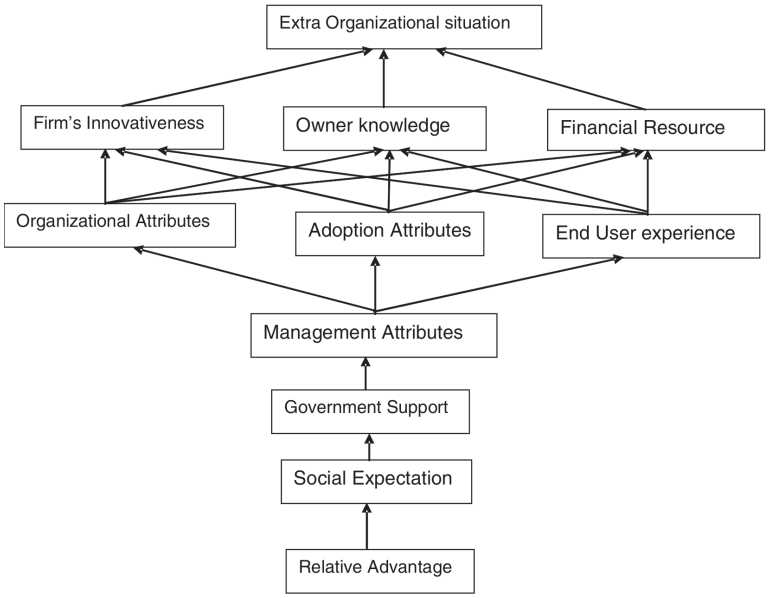

Figure 2: Levels of variables (Validated through ISM)

Discussion and Recommendation

Out of the factors influencing the adoption and implementation of information technology in small scale industries extra organizational situation is the significant one. It is in the first level and has the maximum impact on the adoption and implementation of IT in SSI. In the second level firm's innovativeness, owner knowledge, financial resources are there. They have less influence in the adoption and implementation of information technology in small scale industries. It is followed by organizational attributes, adoption attributes and end user experience at the third level. Management attribute, government support and social expectation are in the fourth, fifth and sixth level in the variables hierarchy. Relative advantage is in the seventh level and it has the minimum influence in the adoption and implementation of information technology in small scale industries. It is recommended that maximum attention should be given for extra organizational situation in implementation of information technology in small scale industries. Then lower level of variables should be considered for the adoption and implementation of information technology in SSI.

Conclusion

Small scale industries have significant role in Indian economy in view of its contribution to production, employment and export. But, since 1991 small-scale industries in India find themselves in very competitive environment due to the globalization. Literature study reveals that information technology is a significant factor which influences the growth of small scale industries. Interpretive Structural Modeling (ISM) is used to determine the level of the factors influencing the adoption and implementation of information technology in the small scale industries. Extra organizational situation is the most influencing factor for the adoption and implementation of information technology by the small-scale industries. Relative advantage has the minimum influence in the adoption of information technology by the small scale industries.

References

- Annual Report (2004-05), Ministry of SSI, Government of India..
- Bala Subrahmanyam, M.H (2005); Small-scale industries in India in the globalisation era: performance and prospects, *Int. J. Management and Enterprise Development*, 2(1), 122-139.
- Bala Subrahmanyam, M.H, Balchandra, P. and Mathirajan (2004); Technological innovations in small scale industries: case studies of two foundries in Karnataka, *South Asian Journal of Management,* 11(3), 111-120.
- Beheshti, H.M. (2004);The Impact of IT on SMEs in the United States, *Information Management and Computer Security,* 12(4), 318.
- Grandon,E.E. and Mykytyn, P.P.(2004); Theory- based instrumentation to measure the intention to use electronic commerce in small and medium sized business, *Journal of Computer Information Systems,* 44(3), 44-57.
- Jeon, B. N. et. al. (2006); Determining the factors for the adoption of e-business: a case study of SMEs in Korea, *Applied Economics, 2006*, 38, 1905-1915.
- Levenburg,.M.N. and Klein,H.A.(2006); Delivering customer services online: identifying best practices of medium-sized enterprises, *Information Systems Journal*, 16(2), 135-155.
- Lee,J. and Maniam,B.(2007); Small Business and Globalization, *The Business Review, Cambridge,* 7(2).
- Narayana,M.R (2006); Awareness of Policies and Programmes among Small-scale Industries in India, *Journal of Asian and African Studies*, 41(4), 319-339.
- Ritches,B. and Brindley, C. (2005);ICT adoption by SMEs: implication for relationships and management, *New Technology Work and Employment*, 20(3).
- Levenburg,.M.N. and Klein,H.A.(2006); Delivering customer services online: identifying best practices of medium-sized enterprises, *Information Systems Journal*, 16(2), 135-155.
- Jeon, B. N. et. al. (2006); determining the factors for the adoption of e-business: a case study

of SMEs in Korea, *Applied Economics*, l.38, 1905-1915.

- Seyal, A.H. and Rahman, M.N.A. (2003), A preliminary investigation of e-commerce adoption in small and medium enterprises in Brunei, *Journal of global Information Technology Management;* 6,2.
- Ihlstrom,C. and Nilsson, M. (2003), E-Business Adoption by SMEs-Prerequisites and attitudes of SMEs in Swedish Network, *Journal of organizational computing and electronic commerce,* 13(3&4), 211-223.
- Wymer,S.A. and Regan, E.A. (2005), Factors influencing e-commerce adoption and use by Small and Medium Businesses, *Electronic Markets,* Dec2005, 15(4), 438-453
- Chahal, H.and Kohali, R. (2006), Managers attitude towards technology orientation in SSIs of Chandigarh- Mohali industrial cluster, *Journal of Services Research*, 6(1), 125-144,
- Khazanchi, D.(2005); Information Technology (IT) appropriateness: The contingency theory of "FIT" and IT implementation in small and medium enterprises, *Journal of Computer Information System,* Spring, 88-95.
- Winston, E.R and Dologite, D.G (1999) Achieving IT Infusion: A Conceptual Model for Small Business, *Information Resource Management Journal,* 12(1), 26-38.
- Lee,J. and Runge,J.(2001) Adoption of Information technology in small business: Testing Drivers of adoption for Entrepreneurs Journal of computer Information System, 41(1), 44-57.
- Romijin, H. (2001) Technology Support for Small-scale Industry in Developing Countries: A Review of Concepts and Project Practices, *Oxford Development Studies*, 29(1), 57-76.
- Gupta,S. and Bawa, R.S. (2006), Growth Performance of Small Scale Industry in Punjab: A comparative Study of Preliberalization and Liberalization Periods, *Apeejay Journal of Management and Technology,* 1(1), 50-55.
- Bhardwaj, R.K and Makkar,U (2005), An Attempt of Revival of small Scale Industries in North-West Belt of India: The Post Liberalization Scenario, *Journal of IMS Group*, 1(1), 62-70.
- Nagesh, N. and Balchandra, P.(2006), Barriers to energy efficiency in small industry clusters: Multi-criteria-based prioritization using the analytical hierarchy process, *Energy*, 31, 1969-1983.
- Chowdhaury, K.K., Gijo,E.V.and Hegde, S.(2000) Role of Organized sectors in Developing small-scale industries as vendors: A Case Study of Experimental Approach, Total Quality Management, 11(2), 171-178.
- Butt, K.A. (2005), Value Chain Management: A Small Industry Perspective, *VISION-The Journal of Business Perspective,* 9(3), 39-54.