

# Adoption of Modern Technology in Microenterprises: A Distant Dream

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**Abstract** - This paper discusses the nature of technology employed by microenterprises in terms of nature of machinery, product design, range and packaging of product and various technological constraints faced by them. In addition to these issues, the paper also studies the various factors affecting the use of modern technology and innovation by microenterprises and the reasons for not using most modern technology. Keeping in view the research issues/questions raised above, the specific objectives are to study production technologies employed by different types of enterprises in terms of techniques of production, product design, packaging of product, and so on. The study was conducted in the state of Himachal Pradesh at the state, district and household /enterprise level. Both the secondary and primary data was collected to accomplish the objectives of the study. The data was analyzed using appropriate statistical tools. The descriptive statistics like averages, percentages were computed to analyze various issues related to socio economic profile, and technological aspects. The other statistical tools used in the analysis of data are weighted rank and regression analysis.

**Key Words:** Microenterprises, Technology, Production, Product Design

## I. INTRODUCTION

Definitions of micro small and medium enterprises (MSMEs) vary from country to country depending upon their economic structures. The commonly used parameters to define MSMEs at international level are the number of employees, total net assets, sales, paid up capital, investment level and annual turnover. For example, in US annual operating revenue and number of employees are the basis of classification for MSMEs. In Taiwan, factors like paid-up capital, number of employees and annual operating revenue are taken into consideration for classification. In UK, the number of employees is the sole criterion. In India, the classification of MSMEs is based on investment in plant, machinery and equipments.

According to Annual report of Ministry of MSME (2013-14), MSME sector consists of any enterprise, whether proprietorship, Hindu undivided family, association of persons, cooperative society, partnership or undertaking or any other legal entity, by whatever name it is called, engaged in production of goods pertaining to any industry specified in the first schedule of Industry Development & Regulation Act, 1951 and other enterprises engaged in production and rendering services, subject to the limiting factor of investment in plant and machinery and equipments respectively as noted below:

For manufacturing sector, an enterprise is classified as:

(a) Micro enterprise, if investment in plant and machinery does not exceed Rs. twenty-five lakhs

(b) Small enterprise, if investment in plant and machinery is more than Rs. twenty five lakhs but does not exceed Rs. five crores; or

(c) Medium enterprise, if investment in plant and machinery is more than Rs. five crores but does not exceed Rs. ten crores;

In case, enterprise is engaged in providing or rendering of services, it is classified as:

(a) Micro enterprise, if investment in equipment does not exceed Rs. ten lakhs;

(b) Small enterprise, if investment in equipment is more than Rs. ten lakhs but does not exceed Rs. two crores; or

(c) Medium enterprise, if investment in equipment is more than Rs. two crores but does not exceed Rs. five crores.

In most of the previous studies MSMEs have been jointly studied which include micro, small and medium enterprises. There is a significant difference between the micro, small and medium enterprises in terms of investment in plant and machinery and resources available to microenterprises as compared to small and medium enterprises.

Another important aspect related to the literature on microenterprises in India is that most of studies are based on the annual reports of the MSME ministry, economic census and NSS reports and have focused on the nature of microenterprises, their role in employment generation, role in GDPs, and role of several government agencies in their promotion (Tybout, 2000; Jeppesen, 2007; Hyman, 2012; Boyer and Blazzy, 2013; Bischoff and Wood, 2013; Wit and Kok, 2014). As a result, ignoring many more important

issues related to the use of technology in these enterprises. As we, all know that the use of modern technology is *sine qua non* for the success of any enterprise in today's competitive world. Technology in the context of an enterprise encompasses the use of modern machinery, use of modern means of ICT, modern means of packaging the products, and so on. It is against this background that this paper discusses the nature of technology employed by microenterprises in terms of nature of machinery, product design, range and packaging of product and various technological constraints faced by them. In addition to these issues, the paper also studies the various factors affecting the use of modern technology and innovation by microenterprises and the reasons for not using most modern technology. Keeping in view the research issues/questions raised above, the specific objectives are to study production technologies employed by different types of enterprises in terms of techniques of production, product design, packaging of product, and so on.

Toward meeting our research objective, the paper has been organized as follows. Next, we discuss the review of literature. Then, we proceed by explaining how the present study was conducted and data analyzed. Results of the analyses are presented next, followed by a discussion on the findings. Some concluding remarks, limitations of the present research, and implications of the findings to practice and future research are offered next.

## II. REVIEW OF LITERATURE

New technology has made a big impact on every part of the business world and rural microenterprises in nonfarm sector are not untouchable from its impact. The new technology in rural nonfarm microenterprises may be introduced through private sector, public sector, NGOs or individuals. In rural non-farm sector, significant cost savings and productivity has resulted from the adoption of new technology (Haggleblade and Minot, 1987; Carr, 1996; Hyman, 1990; Haggleblade and Ritchie, 1992; Haggleblade, 1987). Singh *et al* (2012) in their study related to micro, small and medium enterprises (MSMEs) have found that these enterprises play an important role in national economy by contributing significantly towards nation's Gross Domestic Product (GDP), employment generation and exports. Despite this, this sector is plagued with problems that threaten its survival. The major problems faced by MSMEs that affect their performance are government policies, taxation rules, power availability, training facility and lack of Advance Manufacturing Technologies (AMT) etc. The findings suggest that there exists considerable scope to improve the performance of MSMEs provided they adopt suitable AMT.

Patil and Chaudhary (2014) in their study have found that observed lack of machinery and equipment as one of the important constraints faced by MSMEs. MSMEs are striving hard to employ modern machinery and equipment

in order to compete with large industries. Most of the MSMEs are forced to use outdated and traditional technology mainly because of lack of adequate infrastructure, irregular supply of raw material and lack of training. Kumar *et al* (2009) in their paper have mentioned that technological upgradation and modernization have assumed great significance in the present day context. With the introduction of latest technology, reducing the cost of production and the increasing competition from within and outside, the small MSME enterprises will have to attach more importance and pay attention to the areas of technology up gradation and modernization. However, due to lack of information on the areas of technology up gradation, entrepreneurs who have plans for technical up gradation do not go for upgradation. The report on technology upgradation in microenterprises submitted by National Commission for Unorganized Sector (2009) have found accessing modern technology and maintaining competitiveness is the main problem faced by MSMEs in India. The main reasons for this are poor financial situation and low levels of R&D, poor adaptability to changing trade trends and desire to avoid risk. Another reason for not going for technology upgradation include non-availability of technically trained human resources, emphasis on production and not on production costs, lack of management skill, lack of access to technological information and consultancy services.

Cromie (1991) in his study has mentioned lack of funds as one the main constraints due to which MSMEs are forced to use inferior equipments, economize on consumables and are not able to upgrade technology. Similarly Hernandez-Trillo *et al* (2005) in their research have found that availability of the credit as major constraint in the maintenance or improvement of technology.

The studies have revealed that new technology has made a wide impact on every part of the business world but most of MSMEs are still using obsolete and traditional technology. Lack of modern machinery and equipment is one of the important constraints faced by the MSMEs. The main reasons for not using most modern technology is lack of adequate infrastructure, irregular supply of raw materials and lack of training. The another reason for not opting the technology upgradation includes low levels of R&D, poor adapting of changing trade trends and desire to avoid risk.

## III. METHODOLOGY

### Area, universe and units of the study

The study was conducted in the state of Himachal Pradesh at the state, district and household /enterprise level covering the microenterprises in four blocks i.e. Kangra, Indora, Dehra and Nurpur of Kangra district. The sample for the study was selected in the following manner. To begin with, out of twelve districts of the state, Kangra with the highest

concentration of microenterprises in manufacturing, as is evident from table 1.1, was selected purposively.

Table 1.1: District wise total number of enterprises, 2005-06

S.No.	District	Rural	%age	Total	%age
1.	Bilaspur	14892	6.92	17950	6.70
2.	Chamba	14184	6.59	16896	6.31
3.	Hamirpur	16478	7.66	19962	7.45
4.	Kangra	53489	24.39	60250	22.50
5.	Kinnaur	3969	1.81	3969	1.48
6.	Kullu	14514	6.74	19246	7.19
7.	Lahaul & Spiti	1963	0.91	1963	0.73
8.	Mandi	32819	15.25	39190	14.64
9.	Shimla	19286	9.21	30013	11.21
10.	Sirmour	13243	6.15	17007	6.35
11.	Solan	15924	7.40	22405	8.37
12.	Una	14947	6.94	18932	7.07

Source: Economic census of Himachal Pradesh: 2005

Again, out of this selected district, four blocks with the highest concentration of microenterprises in manufacturing were selected purposively. Once the blocks were selected, a list of registered and unregistered microenterprises was prepared for each of the selected blocks. The list of registered microenterprises was compiled from DIC. Among these blocks, the major category of enterprises belongs to iron and steel works, wooden furniture and flour and rice mills. The total number of registered microenterprises was 324; out of these 78 were located in Kangra block, 96 in Indora, 56 in Dehra and 44 were found in Nurpur block. Out of total registered enterprises one-third to one-half of the enterprises were selected randomly from each of the selected blocks. The total number of the enterprises selected comes to be 108. Equal number of unregistered enterprises was also selected following a simple random sampling procedure. The composition of the enterprises on the basis of registration and block wise is shown in table 1.2

Table 1.2: Distribution of sample enterprises according to registration

Registration/Block	Kangra	Indora	Dehra	Nurpur	All
Registered	26	32	28	22	108

Table 1.3: Distribution of enterprises according to age and gender of entrepreneurs (Percentage)

Particular/block	Kangra	Indora	Dehra	Nurpur	All
<b>Registered enterprises</b>					
<b>Age(Years)</b>					
20-30	14.8	3.0	4.3	4.0	6.4
31-40	51.9	45.5	52.2	68.0	54.3
41-50	14.8	33.3	34.8	24.0	26.8
51-60	14.8	15.2	8.7	4.0	10.8
61-70	3.7	3.0	0.0	0.0	1.8
Total	100.0(26)	100.0(32)	100.0(28)	100.0(22)	100.0(108)
<b>Gender</b>					
Male	92.6	84.8	82.6	84.6	86.2
Female	7.4	15.2	17.4	15.6	13.8
Total	100.0(26)	100.0(32)	100.0(28)	100.0(22)	100.0(108)
<b>Unregistered enterprises</b>					
<b>Age(Years)</b>					
20-30	3.7	6.5	13.3	10.5	8.2

enterprises					
Unregistered enterprises	26	32	28	22	108
All	52	64	56	44	216

Source: Field Survey, 2013-14

Note: Figures in parentheses are the number of selected enterprises

### The Data

Both the secondary and primary data was collected to accomplish the objectives of the study. The secondary data required was collected from the published reports of economic census of Himachal Pradesh and district industries centre, Dharamshala. The primary data was collected from the entrepreneurs with the help of a well-defined pre-tested schedule. For pilot testing of the schedule, 20 respondents were interviewed. After collecting data from 20 respondents, schedule was examined for omissions, layout problems and checking error, if any. The data from the selected entrepreneurs was collected through a personal interview method for the year 2013-14.

### Analysis of data

The data was analyzed using appropriate statistical tools. The descriptive statistics like averages, percentages were computed to analyze various issues related to socio economic profile, and technological aspects. The other statistical tools used in the analysis of data are weighted rank and regression analysis.

### RESULTS

Table 1.3 shows the age and gender wise distribution of the respondents. Considering the overall picture of both registered and unregistered enterprises, the proportion of the respondents in all the blocks who are in the age group of 31-40 years varies between 50.2% in Indora and 63% in Nurpur which contradicts the hypothesis that entrepreneurs operating these microenterprises are comparatively old. According to gender, a preponderant majority of enterprises both in registered and unregistered enterprises, is owned by males in all the blocks.

31-40	59.3	54.8	63.3	57.9	58.5
41-50	29.6	25.8	16.7	5.3	19.5
51-60	7.4	12.9	6.7	26.3	13.8
61-70	0.0	0.0	0.0	0.0	0.0
Total	100.0(26)	100.0(32)	100.0(28)	100.0(22)	100.0(108)
<b>Gender</b>					
Male	85.2	96.8	90.1	78.9	88.0
Female	14.8	3.2	9.1	21.1	11.9
Total	100.0(26)	100.0(32)	100.0(28)	100.0(22)	100.0(108)
<b>All enterprises</b>					
<b>Age(Years)</b>					
20-30	9.3	4.8	8.8	7.3	7.4
31-40	55.6	50.2	57.8	63.0	56.4
41-50	22.2	29.6	25.8	14.7	23.2
51-60	11.1	14.1	7.7	15.2	12.1
61-70	1.9	1.5	0.0	0.0	0.9
Total	100.0(52)	100.0(64)	100.0(56)	100.0(44)	100.0(216)
<b>Gender</b>					
Male	88.9	90.8	86.4	81.75	87.1
Female	11.1	9.2	13.3	18.35	12.9
Total	100.0(52)	100.0(64)	100.0(56)	100.0(44)	100.0(216)

Note: Figures in parentheses are total number of enterprises/entrepreneurs based on which percentages have been calculated.

Source: Field survey, 2013-14

### Type of machinery used

Table 1.4 presents the distribution of enterprises according to the use of traditional and modern machinery. Considering both types of enterprises, the proportion of enterprises using modern machinery is 42.3% in Kangra, 41.1% in Indora, 38% in Nurpur blocks and around 29% in Dehra. The proportion of those using semi traditional machinery across the block varies from nearly one-third in Kangra to more than 50% in Dehra.

Table1.4: Percent distribution of sample entrepreneurs using traditional and modern machinery

Particular/Block	Kangra	Indora	Dehra	Nurpur	All
<b>Registered enterprises</b>					
Traditional	23.1	15.6	3.6	9.1	12.8
Semi Traditional	26.9	34.4	60.7	45.5	41.3
Modern	50.0	46.9	32.1	40.9	42.1
Most Modern	0.0	0.0	3.6	4.5	1.8
Total	100.0	100.0	100.0	100.0	100.0
<b>Unregistered enterprises</b>					
Traditional	19.2	21.9	17.9	9.1	17.4
Semi Traditional	38.5	40.6	46.4	50	43.1
Modern	34.6	34.4	25	36.4	32.1
Most Modern	0.0	0.0	0.0	0.0	0.0
Total	100	100	100	100	100
<b>All enterprises</b>					
Traditional	21.2	18.8	10.8	9.1	21.2
Semi Traditional	32.7	37.5	53.6	47.8	32.7
Modern	42.3	40.7	28.6	38.7	42.3
Most Modern	0.0	0.0	1.8	2.3	0.0
Total	100.0	100.0	100.0	100.0	100.0

Source: Field survey, 2013-14

### Use of ICT, innovation and improvement in machinery and product

Table 1.5 gives details of the percentage distribution of enterprises according to use of information and communication technology. The most commonly used mean for ICT technology was the use of mobile phone in all the four blocks.

Table 1.5: Percent distribution of enterprises according to use of information & communication technology (ICT)

Particular/Block		Kangra	Indora	Dehra	Nurpur	All
<b>Registered enterprises</b>						
Whether using modern means	Yes	84.6	87.5	82.1	72.7	81.6

of ICT	No	15.4	12.5	17.9	27.3	17.4
	Total	100.0 (26)	100.0 (32)	100.0 (28)	100.0 (22)	100(108)
(i) Mobiles		76.9	78.1	71.4	54.5	70.6
(ii) Computers		3.8	3.1	3.6	9.1	4.6
(iii) Internet		3.8	6.3	7.1	4.5	5.5
(iv) Others		0.0	0.0	0.0	4.5	0.9
(v) None		15.4	12.5	17.9	27.3	17.4
Total		100.0 (26)	100.0 (32)	100.0 (28)	100.0 (22)	100(108)
<b>Unregistered enterprises</b>						
Whether using modern means of ICT	Yes	76.9	75.0	82.1	86.4	78.8
	No	23.1	25.0	17.9	13.6	20.2
	Total	100.0 (26)	100.0 (32)	100.0 (28)	100.0 (22)	
(i) Mobiles		73.1	68.8	78.6	81.8	74.3
(ii) Computers		3.8	0.0	3.6	4.5	2.7
(iii) Internet		0.0	3.1	0.0	0.0	0.9
(iv) Others		0.0	3.1	0.0	0.0	0.9
(v) None		23.1	25.0	17.9	13.6	20.2
Total		100.0 (26)	100.0 (32)	100.0 (28)	100.0 (22)	100(108)
<b>All enterprises</b>						
Whether using modern means of ICT	Yes	80.8	81.3	82.1	79.6	80.2
	No	19.3	18.8	17.9	20.5	18.8
	Total	100.0 (52)	100.0 (64)	100.0(56)	100.0 (44)	100(216)
(i) Mobiles		75.0	73.5	75.0	68.2	72.5
(ii) Computers		3.8	1.6	3.6	6.8	3.7
(iii) Internet		1.9	4.7	3.6	2.3	3.2
(iv) Others		0.0	1.6	0.0	2.3	0.9
(v) None		19.3	18.8	17.9	20.5	18.8
Total		100.0 (52)	100.0 (64)	100.0(56)	100.0 (44)	100(216)

Note: Figures in parentheses are total number of enterprises/entrepreneurs based on which percentages have been calculated.

Source: Field survey, 2013-14

Table 1.6 presents the distribution of enterprises according to innovation and improvement in machinery and product. The analysis of pooled data for both the categories of enterprises reveals that around 56% to 62% of the enterprises in all the blocks have brought about innovation/invention in the methods of production, which contradicts the perceived notion that rural nonfarm microenterprise, are not innovative. More than three-fourths of the enterprises in Dehra block and around one-half in Kangra, Indora and Nurpur have also introduced new machines to stay economically viable. Around two-fifths of the enterprises in all the blocks and 13.3% in Dehra have transformed their workshops. Around 70% of the enterprises in Indora block and 58% in Kangra block have improved the quality of their products whereas this proportion is nearly 48% and 53% in Dehra and Nurpur blocks respectively. Likewise, three-fifths of the enterprises each in Indora and Dehra blocks have started making new products whereas this proportion is 48% in Kangra 57% in Nurpur. Most of the enterprises in all the blocks also report that they can repair the machinery in case of any breakdown. Feedback from the customers and competition in the market are the major sources of inspiration to entrepreneurs to change product/product design in all the blocks. In addition, the proportion of entrepreneurs who have contacts with those from where new technology can be acquired varies from around 16% each in Dehra and Nurpur to 27% in Kangra.

Table 1.6: Distribution of enterprises according to innovation and improvement in machinery and product (Percentage)

Particular/Block		Kangra	Indora	Dehra	Nurpur	All
<b>Registered enterprises</b>						
(i) Whether brought innovation/invention in the method of production		42.3	56.3	71.4	68.2	58.7
If Yes,	Introduction of new machines	54.5	50.0	86.7	40.0	58.1
	Transformed the workshop	36.4	38.9	13.3	35.0	30.5
	Others	9.1	11.1	0.0	25.0	10.4
	All	100.0 (11)	100.0 (18)	100.0 (15)	100.0 (20)	100(64)
(ii) Whether improved the quality of product		60.2	56.3	49.4	60.4	64.5

If Yes,	Started making new products	60.0	53.8	63.6	54.5	54.5
	Modified the products	13.6	30.8	22.7	27.4	27.4
	Changed the raw material to improve the product	0.0	7.7	13.6	8.4	8.4
	Other	4.5	7.7	0.0	3.3	3.3
	All	100.0 (10)	100.0(13)	100.0 (22)	100.0 (15)	100(60)
(iii) Repairing machinery in case of breakdown		91.4	44.1	73.9	69.6	67.9
(iv) Source of Inspiration to change product/product design, etc.	Customers	35.3	65.2	36.4	40.0	44.8
	Competition in the market	41.2	26.1	40.9	33.3	34.8
	Self motivation	23.5	0.0	0.0	20.0	9.6
	Product buying firm	0.0	8.7	13.6	13.3	8.7
	Other	0.0	0.0	9.1	0.0	2.4
All	100.0 (17)	100.0 (23)	100.0 (22)	100.0 (15)	100(77)	
(v) Contacts with those who use more modern technology		23.1	12.5	14.3	13.6	15.6
(vi) Contacts with sources from where new technology can be acquired		19.2	9.4	7.1	18.2	12.8
(vii) Advantages in technology from local enterprises		11.5	12.5	10.7	13.6	11.9
<b>Unregistered enterprises</b>						
(i) Whether brought innovation/invention in the method of production		69.2	62.5	53.6	50.0	58.7
If Yes,	Introduction of new machines	50.0	40.0	66.7	54.5	57.0
	Transformed the workshop	38.9	35.0	33.3	36.4	30.2
	Others	11.1	25.0	0.0	9.1	11.7
	All	100.0 (18)	100.0 (20)	100.0 (15)	100.0 (11)	100(64)
(ii) Whether improved the quality of product		57.7	68.8	46.4	45.5	55.0
If Yes,	Started making new products	40.0	63.6	53.8	60.0	54.0
	Modified the products	46.7	22.7	30.8	13.6	28.5
	Changed the raw material to improve the product	13.3	13.6	7.7	0.0	9.1
	Other	0.0	0.0	7.7	4.5	2.9
	All	100.0 (15)	100.0 (22)	100.0 (13)	100.0 (10)	100(60)
(iii) Repairing machinery in case of breakdown		76.9	71.9	78.6	81.8	76.1
(iv) Source of Inspiration to change product/product design, etc.	Customers	27.8	36.0	52.2	0.0	39.4
	Competition in the market	38.9	24.0	21.7	39.4	25.7
	Self motivation	16.7	40.0	26.1	25.7	27.4
	Product buying firm	16.7	0.0	0.0	27.4	6.5
	Other	0	8.0	0	6.5	2.3
All	100.0 (18)	100.0 (25)	100.0 (23)	100.0 (16)	100(82)	
(v) Contacts with those who use more modern technology		30.8	21.9	17.9	18.2	22.0
(vi) Contacts with sources from where new technology can be acquired		34.6	25.0	14.3	22.7	23.8
(vii) Advantages in technology from local enterprises		19.2	18.8	14.3	22.7	18.3
<b>All enterprises</b>						
(i) Whether brought innovation/invention in the method of production		55.8	59.4	62.5	59.1	58.7
If Yes,	Introduction of new machines	51.7	48.7	76.7	49.8	57.6
	Transformed the workshop	38.0	40.3	13.3	38.8	30.4
	Others	10.3	21.0	0.0	20.4	11.1
	All	100(29)	100(38)	100(30)	100(31)	100(128)

(ii) Whether improved the quality of product		58.0	69.0	47.7	53.0	59.8
If Yes,	Started making new products	48.0	60.0	60.0	56.7	54.3
	Modified the products	33.5	25.7	25.7	21.9	28.0
	Changed the raw material to improve the product	8.0	11.4	11.4	5.0	8.8
	Other	1.8	2.8	2.8	3.8	3.1
	All	100(25)	100(35)	100(35)	100(25)	100(120)
(iii) Repairing machinery in case of breakdown		73.2	68.0	76.3	75.7	72.0
(iv) Source of Inspiration to change product/product design, etc.	Customers	31.5	50.3	44.5	19.6	42.0
	Competition in the market	40.0	25.0	31.1	36.4	30.2
	Self motivation	20.0	20.4	13.3	22.9	18.7
	Product buying firm	8.5	4.3	6.7	20.5	7.6
	Other	0.0	4.0	4.6	3.3	2.4
	All	100(35)	100(48)	100(45)	100(31)	100(159)
(v) Contacts with those who use more modern technology		27.0	17.2	16.1	15.9	18.8
(vi) Contacts with sources from where new technology can be acquired		26.9	17.2	10.7	20.5	18.3
(vii) Advantages in technology from local enterprises		15.4	15.7	12.5	18.2	15.1

Note: Figures in parentheses are total number of enterprises/entrepreneurs based on which percentages have been calculated.

Source: Field Survey, 2013-14

### Factors affecting the adoption of modern technology and innovation

Table 1.7 presents the results of logistic regression model estimated to determine the factors affecting the probability of adoption of modern technology in microenterprises. While the adoption/not adoption of modern technology is the dependent categorical variable, variables like initial investment, net returns, availability of labour, credit facility and technical education are considered as independent variables. Again, in case of all enterprises (model-III) variables like net returns, credit facility and technical education have positive and significant effect on the probability of the adoption of new technology while the variables like initial investment, availability of labour and credit flow have positive but statistically insignificant effect. The values of Cox and Snell and Neglelkerke R squares are 0.231 and 0.197 respectively indicating that model fitted well to the data.

Table 1.7: Factors affecting the probability adoption of modern technology in micro enterprises: Results of logistic regression analysis

Independent Variables	Model-I (Registered)			Model-II (Unregistered)			Model-III (All)		
	B	Wald	Sig.	B	Wald	Sig.	B	Wald	Sig.
Initial investment ( in Rs)	0.098	15.199	0.140	0.167	7.762	1.210	2.971	11.121	0.319
Net returns (in Rs)	0.066	5.867	0.015**	1.127	3.854	0.031**	1.345	4.967	0.028**
Availability of labour(dummy; Yes=1,else=0)	0.058	1.690	0.135	1.043	0.318	0.349	1.058	3.412	0.137
Credit facility (dummy; Yes=1,else=0)	1.013	0.012	0.013**	2.012	3.132	0.032**	3.041	1.091	0.049**
Technical education(Yes=1,else=0)	3.562	5.212	0.022**	1.312	1.765	0.077*	1.231	7.524	0.077*
Constant	1.324	1.212	0.259	0.876	1.932	1.550	3.451	0.654	0.159
Cox & Snell R square	0.280			0.371			0.231		
Neglekerke R square	0.408			0.231			0.197		

Note:\*, \*\* and \*\*\* denote level of significance at 10%, 5% and 1% respectively.

The results of logistic model fitted to quantify the factors affecting the innovative behavior of the entrepreneurs have been presented in table 1.8 The results of logistic regression for all entrepreneurs (model-III), both registered as well as unregistered enterprises, show that the variables like gender, feedback from customers, technical education and nature of experience have positive and statistically significant effect on the probability of an entrepreneur being innovator while the effect of net returns is positive but statistically insignificant. The values of Cox and Snell and Neglelkerke R squares are 0.198 and 0.277 respectively, which are reasonably high to suggest that model fits the data reasonably well.

Table 1.8: Factors affecting Innovation in micro enterprises: Results of logistic regression analysis

Independent Variables	Model-I (Registered)			Model-II (Unregistered)			Model-III (All)		
	B	Wald	Sig.	B	Wald	Sig.	B	Wald	Sig.
Net returns (in Rs)	1.078	7.279	0.240	2.066	8.164	0.240	1.079	10.264	0.240
Gender (dummy; Male=1,else=0)	1.038	5.580	0.027**	2.036	7.371	0.037**	1.047	8.761	0.087*
Feedback from customers (dummy; Yes=1,else=0)	2.033	1.013	0.024**	1.039	2.024	0.044**	1.021	3.015	0.077*
Technical education (dummy; Yes=1,else=0)	2.262	1.231	0.322	1.165	2.452	0.022**	2.156	6.351	0.049**
Nature of experience(dummy; Related to production=1, else =0)	2.135	2.232	0.378	1.155	1.342	0.048**	1.186	1.243	0.023**
Constant	2.123	1.013	0.815	4.226	2.023	0.015**	1.245	1.034	0.037**
Cox & Snell R square	0.181			0.390			0.198		
Neglekerke R square	0.317			0.341			0.277		

Note:\*, \*\* and \*\*\* denote level of significance at 10%, 5% and 1% respectively.

### Reasons for not using the most modern machinery

Tables 1.9 to 1.12 show the reasons for not using the most modern technology in different sample blocks. Considering both types of enterprises together, very high cost/initial investment is the main reason for not using the most modern technology followed by lack of finance, lack of training, lack of technical knowhow/adequate skills and lack of availability.

Table 1.9: Reasons for not using the most modern machinery in Kangra block: Perception of entrepreneurs (Percentage)

Reasons/Rank	Rank 1	Rank 2	Rank 3	Rank 4	Rank 5	Rank 6	Weighted Rank
<b>All enterprises</b>							
Lack of finance	0.0	21.8	42.0	15.9	6.3	1.9	31.9
Lack of technical knowhow/adequate skills	0.0	3.9	16.1	44.1	23.9	6.0	28.1
Lack of availability	0.0	0.0	20.2	18.1	39.9	18.0	26.0
Lack of training	4.0	46.7	1.9	3.9	11.9	11.9	30.4
Very high cost/initial investment	88.0	2.1	0.0	0.0	1.9	2.1	44.6
Non availability of spare parts	1.9	18.0	4.0	10.1	2.1	47.9	23.3
Uncertainty of demand	4.0	7.7	10.1	2.1	10.3	2.1	19.4

Source: Field Survey, 2013-14

Table 1.10: Reasons for not using the most modern machinery in Indora block: Perception of entrepreneurs (Percentage)

Reasons/Rank	Rank 1	Rank 2	Rank 3	Rank 4	Rank 5	Rank 6	Weighted Rank
<b>All enterprises</b>							
Lack of finance	0.0	24.7	41.4	13.1	6.3	2.7	32.3
Lack of technical knowhow/adequate skills	0.0	2.4	15.5	45.3	18.5	5.1	26.8
Lack of availability	0.0	2.7	19.4	12.8	44.1	15.8	26.0
Lack of training	2.4	45.6	5.4	2.4	11.6	15.8	30.2
Very high cost/initial investment	84.9	5.1	0.0	1.2	2.7	2.7	44.7
Non availability of spare parts	3.9	17.0	3.9	17.3	2.7	41.4	24.9

Source: Field Survey, 2013-14

Table 1.11: Reasons for not using the most modern machinery in Dehra block: Perception of entrepreneurs (Percentage)

Reasons/Rank	Rank 1	Rank 2	Rank 3	Rank 4	Rank 5	Rank 6	Weighted Rank
<b>All enterprises</b>							
Lack of finance	0.0	24.4	43.5	11.9	9.0	1.8	32.9
Lack of technical knowhow/adequate skills	0.0	4.8	16.7	47.7	15.5	6.6	28.1
Lack of availability	0.0	1.8	20.9	14.9	45.3	13.7	26.5
Lack of training	4.8	44.7	3.6	4.8	12.5	13.7	30.9
Very high cost/initial investment	80.4	6.6	0.0	2.4	1.8	1.8	43.6
Non availability of spare parts	4.2	16.1	4.2	13.1	1.8	43.5	23.9

Source: Field Survey, 2013-14

Table 1.12: Reasons for not using the most modern machinery in Nurpur block: Perception of entrepreneurs (Percentage)

Reasons/Rank	Rank 1	Rank 2	Rank 3	Rank 4	Rank 5	Rank 6	Weighted Rank
<b>All enterprises</b>							
Lack of finance	0.0	24.4	43.5	11.9	9.0	1.8	32.9
Lack of technical knowhow/adequate skills	0.0	4.8	16.7	47.7	15.5	6.6	28.1
Lack of availability	0.0	1.8	20.9	14.9	45.3	13.7	26.5
Lack of training	4.8	44.7	3.6	4.8	12.5	13.7	30.9
Very high cost/initial investment	80.4	6.6	0.0	2.4	1.8	1.8	43.6
Non availability of spare parts	4.2	16.1	4.2	13.1	1.8	43.5	23.9

Source: Field Survey, 2013-14

#### IV. DISCUSSIONS

The discussion on the adoption of modern technology by various microenterprises in different blocks throws up the following main findings. Around two-fifths of the registered enterprises are using the modern machinery while in case of unregistered enterprises around one-third of enterprises use modern machinery. A significant proportion of the entrepreneurs, however, continue to use traditional technology in all the four blocks. Similarly, a very small percentage of the enterprises in all the blocks have availed the govt. support/subsidy to acquire modern machinery. Most of the entrepreneurs in all the blocks are using mobile phone as tool for information and communication. Around three-fifths of the registered and unregistered enterprises have brought about innovation/invention in the methods of production. Customers feedback is the major source of inspiration to change product/product design for nearly two-fifths of both registered and unregistered enterprises. The source of technology for around half of the entrepreneurs of both registered as well as unregistered enterprises in all the blocks is other neighboring producers. The results of logistic regression analysis shows that factors like net returns, credit facility and technical education have positive and statistically significant effect on the probability of adoption of new technology in both registered as well as unregistered enterprises while variables like initial investment and availability of labour have positive but statistically insignificant effect. Similarly, the results of logistic regression also show that in case of both registered and unregistered enterprises, gender and feedback from customers enhances the probability of entrepreneurs being innovator. Among reasons reported for not using the most modern technology, very high cost /initial investment is most important followed by lack of availability of labour and lack of technical knowhow /adequate skills.

#### V. CONCLUSION

In so far as the of adoption of modern technology by the sample entrepreneurs is concerned, the analysis suggests that a majority of the entrepreneurs are using modern or semi traditional technology and only a small proportion of the entrepreneurs had adopted the most modern technology. However, the percentage of the entrepreneurs who were using modern and most modern machinery was higher

among registered enterprises as compared to unregistered enterprises. The proportion of entrepreneurs availing govt. support available under different schemes was very low among both types of enterprises. Again, however, the percentage of the entrepreneurs who have availed such subsidies and amount of subsidies availed is higher for registered enterprises as compared to unregistered enterprises. The major sources of technology for these enterprises are other neighbouring producers. Around three-fifths of the entrepreneurs have brought out innovation in the methods of production and across blocks; a preponderant majority of those who brought about changes in the methods of production did so by introducing new machines, introducing new products and by modifying their workshops. Similarly, a majority of the entrepreneurs also reported to have improved the quality of the products. Among different factors, customer feedback was the main source to improve the quality of product. The results of logistic regression analysis further shows that factors, namely, net returns, credit facility and technical education had positive effect on the probability of an entrepreneur being the adopter of modern technology. The factors like gender, feedback from the customers, technical education and nature of experience were also found to enhance the probability of an entrepreneur being an innovator. Regarding constraints faced by the entrepreneurs in the adoption of modern technology, very high cost/initial investment followed by lack of availability and lack of technical knowhow/adequate skills were important, these constraints have also been reported by previous studies (Patil and Chaudhry, 2014; Kumar et al, 2009; Singh et al, 2012; Trillo et al, 2005).

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