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# ASSESSMENT OF RURAL DIGITAL IMAGING AND CREATIVITY ABILITIES FOR POTENTIAL CROWDSOURCING CASE

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## ***ABSTRACT***

*Benefits of crowdsourcing tasks are largely reaped by urban rather than rural workers. Even if rural workers could access these web portals, tasks are in general elementary. This research aims to see whether rural crowdsourcing workers' digital imaging ability is better than urban workers, and whether creative ability leads to better imaging ability. Understanding this comparative scenario along with contextual factors (such as confidence level of manager on workers, job satisfaction and work situation) influencing these parameters helps to crowdsourcing skillful computational digital imaging jobs to rural workers. These understandings were studied by collecting data from 120 IT workers (60 each from semi-urban and rural areas) located in six states of India. Statistical analyses show that urban BPO workers' were better than rural workers only in 2D digital imaging ability (not in 3D ability), but rural workers were better in Torrance Tests of Creativity Thinking (TTCT) test. Association between worker's creativity and manager assessment is not aligned for rural workers. In contradict to expectation, the findings show that workers with low job satisfaction and excellent work circumstances lead to possess high creativity skills in TTCT creativity score. Next steps involve improving digital imaging and creativity abilities of workers, and aligning manager conviction on worker's creativity.*

**Keywords:** *Creativity, Rural India, Crowdsourcing, TTCT, Manager assessment.*

## **1. INTRODUCTION**

In India, 70% of the population lives in rural areas. Economic growth must expand beyond cities to cover basic needs of rural parts. Digital innovation is creating new opportunities to bridge widening urban-rural employment gap. It aids to develop novel information and communication infrastructure that is suitable for rural development needs. For example, Seth et al. (2006) developed a low cost communication for rural internet kiosks using mechanical backhaul. This kind of infrastructure development along with growing crowdsourcing scenario helps to bring global jobs to rural areas. Crowdsourcing is the act of taking a job traditionally performed by a designated agent (usually an employee) and outsourcing it to an undefined, generally large group of people in the form of an open call (Howe, 2006). With adequate infrastructure, available human resources, and motivation from private sector, presently more than 100 rural business process outsourcing (BPO) units are estimated to be operating around India, most of them less than three years old (Wharton, 2010). This trend is closely observed in the results of analyzing data from six rounds of the National Sample Survey (NSS) of households in India from 1983 to 2009-10, which reveal that expansion of blue-collar occupations jobs (primarily production and service workers) in rural areas at a significantly faster rate than the corresponding expansion of blue-collar occupations in urban areas (Hnatkovskaa and Lahiri, 2013). It helps to lower migration trend from rural to urban areas.

Even though crowdsourcing is rapidly becoming a common tool for business jobs, the large group of people who are mostly benefitted from the \$1-2 billion earned via crowd sourced work allocation (Frei, 2009) seem to be urban and above average income holders both in developing and developed countries (Khanna et al. 2010). Khanna et al. (2010) reported that less than 3% of India-based MTurk workers fall into the demographic of low-income workers. Much effort goes into understanding of crowdsourcing as a tool for innovation and how companies use crowd workers to solve their challenges in developed countries; those pursuing or creating new jobs, however, often overlook that in too many places social exclusion and poverty prevent many, especially rural crowdsourcing workers in developing countries, from participating in and accessing these new jobs. As Kling (1996) reminded us, Information and communication technology (ICT)'s consequences are not universally positive: ICT can contribute to unemployment and increased economic disparity, as well as labor and financial market instability and a host of other social problems.

To take along knowledge and skill enrichment tasks to rural areas, in this research we hypothesize that large numbers of crowdsourcing tasks which requires digital imaging and creativity abilities can be outsourced as human intelligence tasks to rural workers to provide a sustainable source of skilled employment. The following values and relationships need to be identified for crowdsourcing this kind of tasks:

- Digital imaging ability gap between rural and urban workers. This gap will help train rural workers to be competitive to urban workers.
- Digital imaging ability could be judged by 2D/3D spatial tests, and linking imaging ability with creativity levels. Relationship between creativity and digital imaging ability will provide further direction for training workers to improve their imaging ability via creative process.
- BPO manager plays important role in accepting crowdsourcing task based on their judgement of workers' potential. The alignment between confidence levels of manager on worker's creativity potential in comparison to worker's original creativity level needs to be tested.
- Since literature emphasised about importance of job satisfaction and work circumstances on creativity level, this relationship needs to be studied with reference to rural context.

To find answer for these variables, we have conducted digital imaging (2D and 3D) and creative ability tests with 120 workers (60 workers each in rural and semi-urban BPOs) located in six states of India. In addition to these assessments, workers also filled a socio-economic survey. The rest of this paper is structured with related literature which aids to develop hypotheses to be tested, detailed research method and approaches, results from statistical analyses, discussion about important observations, and finally conclusions with ongoing work.

## **2. LITERATURE**

### **2.1 DIGITAL IMAGING AND CREATIVITY ABILITY**

There are basically two ways to judge digital imaging ability. One way is to rely on spatial tests for 2D and 3D reasoning. For instance, we can look for to what extend crowdsourcing workers could generate, retain, retrieve, and transform well-structured visual images (Lohman 1996). Another way to judge digital imaging ability is to link person's imaging ability with creativity levels. For instance, we can evaluate whether crowdsourcing workers' possessing digital ability have high creativity level in terms of

development of original ideas, fluency etc. The extant literature presents conflicting findings to establish association between digital imaging and creativity abilities. For example, Charyton et al. (2011) observed some overlap with creativity and spatial ability in engineers by investigating the correlation between Creative Engineering Design Assessment (CEDA) and Purdue Visualization Spatial Test-Rotations (PSVT-R). Whereas Allen (2010) finds that there is no significant correlation was found between visualization and creativity in interior design students. Along with this kind of contradictions, the reported research was mostly conducted with urban students and people. There is a need to establish potentials of rural workers. Separate effort is required to establish digital imaging ability from rural and urban crowdsourcing workers who have different education and work background.

Majchrzak and Malhotra (2013) defined innovation in a crowdsourcing context as the public generation of innovative solutions to a complex problem posed by the company sponsoring the challenge call. Although innovative implementable solution is important, our research aims to establish rural crowdsourcing for creativity capability enablement for conceiving something original or unusual. Since workers are limited by English language and numerical knowledge, Torrance Tests of Creative Thinking (TTCT-Figural test) was used to assess worker's creative explicit expression. TTCT assessment uses five main parameters to evaluate creativity: fluency, resistance to premature closure, elaboration, originality, and abstractness of titles. These multiple criteria help to study creativity level in greater detail. Since higher creative level could have greater impact on increasing worker's digital imaging ability, this relationship should be studied. To study rural crowdsourcing workers along with urban crowdsourcing workers in the same digital imaging abilities consideration, and observe how well rural crowdsourcing workers perform in digital imaging abilities in relation to their creativity levels, the following hypotheses were framed:

H1. Urban BPO (Crowdsourcing) workers' digital imaging abilities are better than rural BPO workers.

H2. Workers possessing high creativity levels of a) fluency, b) resistance to premature closure, c) elaboration, d) originality and e) abstractness of titles both in urban and rural BPO crowdsourcing workers have high digital imaging ability.

## **2.2 LINK BETWEEN CREATIVITY ASSESSMENTS**

Considering individual creativity is an important element in organization innovation (Amabile, 1988), manager assessing workers' creativity plays vital role in BPO continuous innovation. Usages of manager assessing workers' creativity are mainly applied in management literature to understand influences of leadership on employee creativity. Studies show that workers' creativity assessment helps managers to study relationship between creative performance and job performance (Oldham and Cummings, 1996), leader-member exchange (LMX) and creative performance (Tierney et al. 1999), job dissatisfaction and creativity (Zhou and George, 2001), creative co-worker and creativity (Zhou, 2003), information privacy and creativity performance (Alge et al. 2006), creativity process engagement and overall job performance (Zhang and Bartol, 2010), creative self-efficacy and LMX (Mathisen, 2011) and structural empowerment and creativity (Sun et al. 2012). These understandings could help manager to build necessary individual and organizational mechanisms for better work environment to improve workers creativity such as useful feedback, co-worker support, setting goals, reward structure, less close supervision, resources allocation, leadership behavioral changes etc.

Although manager assessing employee creativity helps to build necessary mechanisms for organizational improvement, there is a gap in literature to address assessing transfer of work-related creativity to new tasks. This gap is important to be addressed considering the argument of Plucker and Runco (1998) that “creative activity within one content area is independent of creativity in other content areas”. This is explicable applicable to our research which aims to transfer workers jobs from doing unskilled work to creative tasks. Since confidence level of manager on workers is paramount important for the success of this research, the objective aims to understand association between worker’s creativity potential and manager conviction on worker’s creativity. The following hypothesis was framed to validate the link between the two creativity assessment tests:

H3: Torrance Tests of Creative Thinking (Figural test) and Manager creativity assessment are correlated.

### **2.3 JOB SATISFACTION AND WORK CIRCUMSTANCES ON CREATIVITY**

Many studies were conducted to identify influences of personal and contextual factors on creative performance in work settings. Basadur et al. (1992) observed that Japanese industries managed creativity by developing structured means to develop motivation, job satisfaction and teamwork. Oldham and Cummings (1996) examination reveal that most creative work occurred “when workers had appropriate creativity relevant characteristics, worked on complex, challenging jobs, and were supervised in a supportive, non-controlling fashion”. But Amabile (2002) argued that creativity was killed under time pressure. Amabile (1987) observed that individuals were expected to be most creative when they were excited about a work activity (intrinsic motivation) which may lead to job satisfaction. Amabile (1988) pointed that creativity requires inclination to engage in deep concentration for long periods of time. Valentine et al. (2011) demonstrated that work context and work response were related by linking group creativity on job satisfaction. But the reverse possibility of job satisfaction influencing creativity was not included in their model. In contradiction, Zhou and George (2001) validated the hypothesis that employees with high job dissatisfaction exhibited the highest creativity when continuance commitment along with useful feedback, helping and support from coworkers, or perceived organizational support were high.

Shalley’s research group produced many journal papers establishing importance of work environment and context on creativity. Shalley et al. (2000) identified that individuals had higher job satisfaction and lower intentions to turnover, when the work environment complemented the creative requirements of the job. Also they observed that proximal job characteristics were more strongly associated with job-required creativity. Shalley and Gilson (2004) reviewed research examining contextual factors that can either foster or hinder employee creativity. They argued that manager should aware of important social and contextual factors to positively affect the occurrence of creativity. Shalley et al. (2009) found that “growth need strength” had both a positive main effect on creativity and an interactive effect with context.

Although many studies identified work context and job satisfaction do play important role in enhancing worker’s creativity, the studies were majorly conducted in urban business scenarios. Variations possible in the rural environment are not studied in-detail. To understand the role of rural work environment and job satisfaction on creativity, the following hypotheses were framed for this research:

H4: Worker with high job satisfaction possesses high creativity skills, in both creativity tests.

H5: Worker with excellent work circumstances possesses high creativity skills, in both creativity tests.

### 3. METHOD

#### 3.1 SAMPLE

To validate the research hypotheses, three semi-urban and rural BPO centers each located in different states of India were selected to get a wider demographic coverage of urban and rural workers. Three centers were chosen from South and North India each respectively. Since these tests were conducted in real-time business environment, the choice of rural workers to participate in this test was controlled by the BPO center. Twenty rural workers participated in each BPO center. Overall, this paper reports the analyzed results of 120 BPO workers (60 workers from semi-urban and rural each). Table 1 presents descriptive statistics about the participated workers. The mean age of rural workers is less than urban workers. Overall, 77% of the participated worker's age range between 20-25 years. Rural workers have less experience than urban workers. But in general, only 28% of the participants have less than one year of work experience. Gender ratio and educational levels are almost equivalent between urban and rural workers. Female population as rural IT workers is increasing due to managers preference for their low attrition rate. It is worthwhile to note that availability of educated population in rural areas is almost equivalent to urban areas.

		Mean	S.D.	Minimum	Maximum
Age (years)	Urban	25	5	16	45
	Rural	22	2	18	30
Total work experience (months)	Urban	30	23	0	144
	Rural	13	11	1	60
Gender	Urban	Male: 57%; Female: 43%			
	Rural	Male: 63%; Female: 37%			
Education	Urban	School pass-outs: 38%; Graduates: 62%			
	Rural	School pass-outs: 37%; Graduates: 63%			

**Table 1. Descriptive statistics about the participated workers**

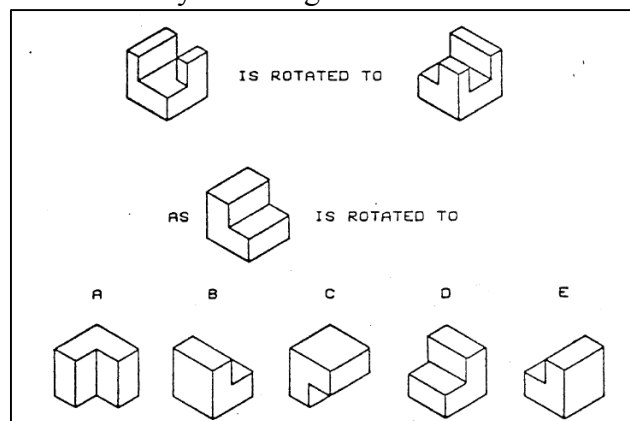
#### 3.2 MEASURES

To assess digital imaging ability, we have chosen the 2D-Multidimensional Aptitude Battery (MAB) for 2D ability (Jackson, 1984), and Vandenberg and Kuse test (1978) and Purdue Spatial Visualization Tests of Rotations (PSVT:R) (Guay, 1976) for 3D ability. The purpose of all these tests is to see how well workers can visualize rotation of two and three dimensional objects within the given time. Table 2 summarizes the details of each of these tests. To illustrate one of these tests, a sample question of PSVT:R is provided in Figure 1. In the given question, the worker should select from among the five drawings (A,B,C,D,E) given in the bottom line of the question that looks like the object in the correct position when the given rotation is applied (identified from the top line object rotation). The option 'D' is the right answer for the sample question. A score of "1" was given for the correct answer, otherwise "0". All the three used tests aim to assess rotational digital imaging ability of workers. Additional image dimension is provided in the 3D tests than the 2D test.

Digital imaging tests	Number of questions	Time given (minutes)	Reliability
2D-MAB	50	7	0.96 (Jackson, 1984)
Vandenberg and Kuse test	24	10	0.88 (Vandenberg and Kuse, 1978)
PSVT:R	20	10	0.80 (Bodner, and Guay, 1997)

**Table 2. Details about the used digital imaging tests**

To assess explicit employee's creativity thinking the figural Torrance Tests of Creativity Thinking (TTCT) was used (Torrance, 1963). The TTCT is one of the most widely used means for quantifying human creativity. TTCT is grouped into various different subtests including verbal and figural tests. We used TTCT figural test in this work because it is suitable for rural workers who have limited language proficiency (non-English speakers). This figural test invite workers to think of ideas (the most interesting and unusual ideas) and to draw them together in various ways. There are three activities: picture construction, picture completion and picture completion using pairs of straight lines. The total time of this test is 30 minutes (10 minutes for each activity). These three activities were assessed by five mental characteristics: fluency, resistance to premature closure, elaboration, abstractness of titles and originality. Total creativity score was calculated by summing the scores of the above five factors.



**Figure 1. Sample question of the PSVT:R test**

Employee creative performance was measured with a 13-item creativity scale developed by Zhou and George (2001). It was completed by rural BPO managers for every worker. Respondents answered on a 5-point scale ranging from 'not at all characteristic' to 'very characteristic'. This scale was chosen because it is highly cited and referred work in this research domain (863 citation overall, and 482 citation since 2011). Also the reliability of this creativity scale is high ( $\alpha = 0.94$ ).

Job satisfaction was measured with three parameters: skills and education match with worker's job, monthly earnings, and working environment ( $\alpha = 0.715$ ). These parameters were seems to be critical for rural IT workers because the existing jobs were low skillful, earnings were less (on average \$80/month), and location of rural BPO centers are remote and could be surrounded by dirty environment. Work circumstances were assessed by five parameters: work concentration, useful roles at work, make good decisions, enjoy day-to-day work activities, and handle problems at work ( $\alpha = 0.643$ ). These parameters were included considering influences on creativity. Both job satisfaction ('very dissatisfied' to 'very satisfied') and work circumstances ('disagree'

to ‘agree’) were answered on a 5-point scale. With these collected measures, the framed hypotheses were validated and presented in the next section.

Age and level of education were used as control variables in testing hypotheses 4 and 5 to ensure that individual demographic status were not influenced to study the associations.

## 4. RESULTS

### 4.1 DIGITAL IMAGING ABILITIES BETWEEN URBAN AND RURAL WORKERS

Table 3 details mean and standard deviation of digital imaging scores of urban and rural workers assessed by the three tests. The independent samples t-tests between urban and rural workers’ scores reveal that statistically significant difference between urban and rural workers is observed only in the 2D-MAB test. The mean of 2D-MAB score of urban workers is higher than the rural workers. However, no significant differences observed for the 3D digital imaging abilities. The statistically validated revised hypothesis is:

H1: Urban BPO (Crowdsourcing) workers’ 2D digital imaging ability is better than rural BPO workers.

Digital imaging tests		Mean	S.D.	t-test
2D-MAB	Urban	18.78	11.62	$t_{118}=2.854, p=0.005$
	Rural	13.80	6.92	
Vandenberg and Kuse test	Urban	5.53	3.6	$t_{78}=.196, p=0.845$
	Rural	5.05	3.45	
PSVT:R	Urban	4.88	2.23	$t_{78}=.602, p=0.549$
	Rural	4.78	2.33	

**Table 3. Mean and standard deviation of digital imaging tests**

### 4.2 CREATIVITY LEVELS AND DIGITAL IMAGING ABILITY

To validate the second hypothesis, digital imaging ability was recorded by summing up the scores of all the three spatial rotation tests. Table 4 presents the regression analysis results for envisaging urban and rural digital imaging ability with creativity parameters. The regression analysis divulges that creativity parameters have statistically significant influence on digital imaging ability for both urban and rural workers. However, looking into the details reveals that only ‘originality’ factor is a common statistically significant factor influencing digital imaging ability between urban and rural workers. But the unstandardized originality regression coefficient is negative for urban workers. Also ‘resistance to premature closure’ is significantly influential in urban workers, but not for rural workers. Since contradictory results are identified between urban and rural workers, this hypothesis is tested false. We could not confirm that workers possessing high creativity levels on the five parameters have high digital imaging ability.



Creativity parameters	Urban			Rural		
	B	SE B	$\beta$	B	SE B	$\beta$
Fluency	.095	.620	.036	-.344	.227	-.205
Originality	-1.930	.849	-.539**	.814	.211	.515*
Elaboration	-3.130	3.886	-.166	1.653	1.481	.159
Abstractness of title	.091	1.500	.011	.803	.446	.259
Resistance to premature closure	5.291	1.258	.721*	-.977	.948	-.152
$R^2$	.628			.690		
$F$	4.424*			6.195*		
* $p < .005$ ; ** $p < .05$						

**Table 4. Regression analysis for envisaging digital imaging ability with creativity parameters**

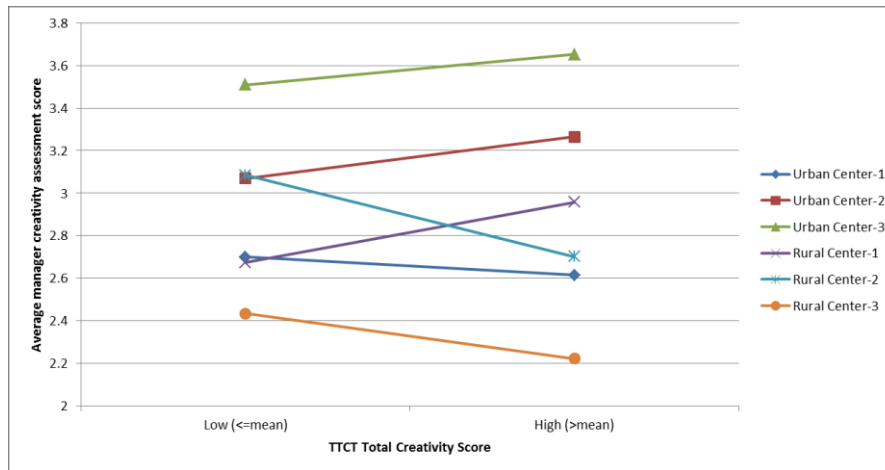
#### 4.3 WORKER'S ORIGINAL CREATIVITY AND MANAGER CREATIVITY ASSESSMENT

Table 5 presents mean and standard deviation of TTCT and Manager creativity assessment score. Both means of TTCT and manager assessing worker's creativity scores for both urban and rural workers are less than literature reported results. The mean TTCT score is about 50 in studies conducted with university students having average age of 20 years (Aslan and Puccio, 2006), and the mean manager assessment creative score is 3.49 (Zhou, 2003). To the surprise that rural workers scored statistically higher than urban workers in TTCT ( $t_{118} = -2.132$ ,  $p < .05$ ). However, manager assessment provides significantly lower score for rural than urban workers ( $t_{118} = 3.980$ ,  $p < .001$ ). Only for the urban centers, there is a statistically significant small correlation observed between TTCT and manager creativity assessment, but the relationship is negative (Table 5). To understand this negative relationship, interaction plot was constructed between these two variables for all BPO centers (Figure 2). Figure 2 illustrates that one manager in urban BPO center (Urban center – 1), and two managers in rural BPO centers (Rural center – 2 and center – 3) largely mispredict the workers creativity with reference to TTCT test. From these observations, the conclusion is that this hypothesis is largely influential by the manager capability to assess workers creativity, and differences are wider in rural BPO centers.

		Mean	S.D.	Minimum	Maximum	Correlation
Torrance creativity test score	Urban	35	15	9	83	
	Rural	40	10	19	71	
Manager creativity assessment	Urban	3.12	.72	1.77	4.54	-.271*
	Rural	2.67	.52	1.69	4	

\*  $p < .05$

**Table 5. Means, Standard deviations and Correlations**



**Figure 2. Urban and rural BPO center interaction plot between TTCT creativity score and manager creativity assessment**

#### 4.4 JOB SATISFACTION, WORK CIRCUMSTANCES AND CREATIVITY SKILLS

The high mean scores of job satisfaction (4.24) and work circumstances (4.62) represent that workers are content with BPO jobs and working environment. Hierarchical multiple regression was carried out to validate the above mentioned hypotheses. In the first stage, the control variables were entered into the regression. In the second stage, the independent variables (job satisfaction and work circumstances) were entered. A statistical test of the change in  $R^2$  from the first stage was used to evaluate the importance of job satisfaction and work circumstances entered in the second stage. Table 6 compares the results of predicting both creativity tests scores with job satisfaction and work circumstances independent factors. The results reveal that the independent factors are statistically best indicators for TTCT creativity score ( $F_{4, 111} = 2.461$ ,  $p < 0.05$ ), rather than manager creativity assessment score. The negative regression coefficient for job satisfaction has rejected the third hypothesis. It indicates that high creativity skills will be exhibited with low job satisfaction. This result is in-line with the observation concluded by Zhou and George (2001), which highlights that employees with high job dissatisfaction exhibited the highest creativity along with the condition such as continuance commitment and organizational support. But work circumstances factor (which incorporates work concentration, useful roles at work, make good decisions, enjoy day-to-day work activities, and handle problems at work) has positive influences on the TTCT creativity score, leading to accept the fourth hypothesis. These combined results show that there are significant variations between the two creativity assessment tests, and the independent variables could able to predict only with certain creativity test. The statistically validated hypotheses are:

- H4: Low job satisfaction leads to possess high creativity skills in TTCT creativity score.  
H5: Excellent work circumstances leads to possess high creativity skills in TTCT creativity score.

	TTCT creativity score			Manager creativity assessment		
	B	SE B	$\beta$	B	SE B	$\beta$
Control variables						
Age	.164	.288	.055	-.011	.016	-.069

Level of education	1.005	1.351	.071	.111	.077	.141
Independent variables						
Job Satisfaction	-3.499	1.590	-.215*	.110	.090	.123
Work Circumstances	5.732	2.392	.238*	.043	.136	.032
$R^2$	0.081			0.033		
$F$	2.461*			0.96		
*p<.05						

**Table 6. Hierarchical multiple regression to validate hypotheses 4 and 5**

## 5. DISCUSSION

Knowledge, learning and innovation are paramount important for bridging urban-rural gaps, especially in employment. Manager belief on workers' creativity is essential to bring global skilful digital imaging and creative jobs to rural areas. Because BPO managers are solely responsible for judging whether outsourced tasks should be accepted in their center. They accept tasks by judging capabilities of rural workers, their skills, and amount of training required to streamline outsourced tasks. Currently most of the rural BPO centers in India are predominately occupied with data entry jobs. To move from unskilled to skilled jobs is a challenge for managers. This research aims to build initial platform for understanding digital imaging and creativity skills of rural workers and compare with urban workers, and manager conviction on their creativity skills, which helps to bring creative outsourced tasks to rural areas.

The first important observation is that gender ratio and educational levels are almost equivalent between urban and rural workers. This contradicts to our expectation considering cultural aspects (where women are constraints by social factors) and agricultural work is predominantly undertaken. Most of the participated workers were young (between 20-25 years). Only in 2D digital imaging ability, urban BPO workers' is better than rural BPO workers. However, for all the three digital imaging tests, both urban and rural workers' mean scores are less than literature reported results (Campos et al. 2000). This ability gap needs to be bridged to make BPO workers competitive to undertake crowdsourcing work (where participants are from all over the world). The hypothesis "workers possessing high creativity levels have high digital imaging ability" is tested false due to contradictory direction predicted for the 'originality' factor between urban and rural workers. This result could be primarily influenced by the sample size of 60 each of urban and rural workers. Increasing the sample size might provide good insights for the relationship between imaging ability and creativity. It should be noted that causal nature of these two parameters were not studied in this work. Providing improvement training for one of these factors, and measuring development in another factor could provide deeper understanding.

Although exceeding the expectations, rural workers scored statistically higher than urban workers in TTCT, the mean creativity scores for both workers are less than literature reported scores. There are multiple factors that could have impacted for this less score. Some are: creativity scope within educational system is very limited, opportunities for creative explicit expression are less, and daily work in BPO center is

limited to rudimentary tasks. Since creativity is widely argued that it could be developed by training (Memmert, 2007), BPO workers should provide chances in daily work with reference to the definition of creative thinking. Creative thinking is the process of “sensing difficulties, problems, gaps in information, missing elements, something askew; making guesses and hypotheses about the solution of these deficiencies; evaluating and testing these hypotheses; possibly revising and restating them; and finally communicating the result” (Torrance, 1963).

Even though rural workers perform better in TTCT test than urban workers, manager assessment provides significantly lower score for rural workers. This result could be due to the fact that manager assessment was based upon routine daily work, where the scope to express creativeness through outcomes and/or processes is very limited. Because the key performance indicators used for data entry work are number of documents typed in an hour, and errors observed. The expected result is to have strong relationships between the two tests results. The negative association noticed for urban workers shows that managers require training to identify suitable workers for creative tasks. This is a challenging task considering variation of creativity levels between tasks, and not influential by level of education of rural workers. The possible approach could be to train managers with appropriate creativity measures used in various tests. For example, explain the parameter definition (fluency, resistance to premature closure, elaboration, abstractness of titles and originality) used in the TTCT test. This understanding perhaps aid to align parameters that are useful for manager assessment.

As observed by Zhou and George (2001) that high job dissatisfaction exhibited the highest creativity in the necessary condition of encouraging the expression of voice, in this research also low job satisfaction leads to explicit expression of high creativity skills. Repetitive unskilled tasks in their daily work could be a reason for unsatisfied workers to showcase other skills possessed by them. Other supporting factors (such as continuance commitment, useful feedback from coworkers, coworker helping and support, and perceived organizational support) influencing this result need to be studied in-detail. The result conclude that irrespective of daily tasks, work circumstances are paramount important for explicitly expressing high creativity skills. However detail study is required to understand which parameters among work circumstances (work concentration, useful roles at work, make good decisions, enjoy day-to-day work activities, and handle problems at work) are important for creative expression. Finally it has been noted that job satisfaction and work circumstances are influential only to the TTCT creative score. It highlights that creativity needs to be studied with many tests to generalize the identified results.

The limitation of this work is that the sample size is only 120 workers. Increasing the sample size will greatly enhance the statistical validity of the results. The ongoing research work aims to conduct the following tasks:

- (i) Aim to increase digital imaging and creative ability of rural workers. The observation from the results is that there are some exceptional talented creative workers in all BPO centers. These workers will play a greater role in training other workers.
- (ii) Training wide variety of creativity measures to improve manager perception on creativity. The challenge is to observe creativity in routine and structured tasks, and transfer it to unstructured tasks.
- (iii) Assessing rural workers abilities in potential outsourced digital imaging and creative tasks (e.g. geometrical reasoning creativity tasks) to investigate their real-time application of their abilities.

## 6. CONCLUSIONS

This research has highlighted possible hindrances to crowdsourcing digital imaging and creative tasks to rural workers. Low digital imaging and creativity scores of rural workers (in comparison to literature results), and negative association between manager conviction and worker's creativity are the primary hindrance factors. However, availability of talented digital imaging and creative workers in every BPO center is a critical resource for implementing training programs. Because transfer of skills through group work could be easier considering limited English knowledge of rural workers. The BPO managers learnt about the possibility of bringing up new digital imaging work, importance of job satisfaction and work circumstances, and variation possible in assessing worker's creativity level with reference to their judgment. To align this misperception, managers need to be trained with wide variety of creativity measures considering current routine work, and its application to imaging and creative tasks. The on-going work is providing training to rural workers to improve their abilities, and apply on real-time business imaging tasks. Since digital imaging tasks were mostly found in manufacturing sector, the current applications are developed in the area of 2D metal sheet packing, and 3D container logistics optimization problems.

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