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Study of the advantages associated with virtual teams in mining sector of Pakistan

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Abstract

Mining organizations cannot produce mineral commodity on cost effective models and therefore unable to compete nationally and globally. These organizations also need to avail the expertise of technical professional from across the globe to be market- competitive. Virtual teams could be an optimum option for these mining organizations. This study aims to highlight the advantages associated with virtual teams in mining sector of Pakistan. For this purpose a questionnaire based survey from mining professionals, researchers and mine owners was conducted. The respondents were asked to respond 20 questions related to the advantages associated with virtual teams on a 5-point Likert scale. Test statistics such as arithmetic mean, median, maximum value, minimum value, skewness and kurtosis were used to analyze the responses. Analysis revealed that top five advantages associated with virtual teams in mining sector of Pakistan are offering dynamic team membership, high degree of cohesion, ability to digitally or electronically unit technical experts from across the globe, cost reduction, and overcoming the geographical and time limitations.

Keywords: Virtual teams, mining, Pakistan, advantages, cost effective, global talent, skewness.

Introduction

With the devaluation of Pakistani rupee in international market, it has become necessary for the mining organization to produce and market mineral commodities at globally competitive prices. For this purpose organizations need to plan strategically about cost cutting. Hiring skilled technical professional mining experts on site may cause cost increments. On the other side these skilled professionals do not prefer to be the part of a remotely located mining project for longer period of time as they perceive such project as a source of social cutoffs, education barrier for their family members and lack of necessities of life. Copper mining project of Bajaur Agency could be a source of huge revenue generation but currently it is not a cost effective project. Dimension stones' mined products have global recognition but produced at a cost-inefficient model compared to the similar exported materials. There are more examples where the mining organizations of Pakistan need to be more cost-effective. These organizations also need to avail and unite the best technical talent from across the globe. To be nationally and globally competitive, organizations need to adopt the models of virtual teams instead of conventional teams.

Virtual team is a group of people working beyond the limitation of space, time and organizational boundaries with a shared purpose through use of information and communication technology-ICT[1,2]. According to Hunsaker and Hunsaker[3] virtual teams have more associated advantages than disadvantages. Virtual teams are more cost effective[4-10], work beyond the limitations of time, space and organizational affiliations[1,5-11]; and offer the team members a dynamic membership across different projects[12].

Virtual teams digitally or electronically unite experts beyond geographical constraints[13]; and hence provide opportunity for investors to avail the best globally available talent[3,4,8,14-16] simultaneously allowing its members greater degree of freedom[4,17-19] to make more effective decisions[20,21] especially related to research and development[22]. Virtual teams are more productive[11,23-26]; efficient[3,27,28]; and generate greater competitive advantage[7, 29]; and higher client satisfaction[30].

Through virtual teams communication and coordination between team members improves[31] creating higher degree of cohesion among members[23,32] and optimized individual contributions for achieving business objective and goals of organization[14]. Virtual teams are useful to deliver large scale operational or commercial projects[33]. Virtual teams enhance self-assessment opportunities to the team members[34, 35].

Mining organizations across the globe have started development of virtual teams. Few of such companies are AngloGold Ashanti and Rio Tinto which utilize virtual teams for the purpose of business development; and mine monitoring and control respectively. Companies gained advantages through virtual teams were globally dispersed clients, high velocity of business and fulfilling customers' needs beyond time constraints at lowered cost. Few mining vendor companies included in this list

are Mining Information Systems, Modular Mining Systems and 3D-P Technologies which utilize virtual teams for the supply of IT based solutions chiefly related to the mining industry etc.

The concept of virtual teams in mining sector of Pakistan is still unfamiliar. No research has been done to create awareness and analyze the need and advantages associated with virtual teams in mining business of Pakistan. Mining organizations in Pakistan still search for professionals with hard core expertise and require from them full-time presence on the mining project. This research aims to identify the top five advantages associated with the virtual teams in mining sector of Pakistan so that mining investors and organizations get familiarity with this phenomenon and mining industry in Pakistan can grow at a better pace.

Methodology

Because this topic is unfamiliar to the professionals associated to the field of mining engineering in Pakistan, both techniques of questionnaires and structured interviews were adopted for this research thesis. The reason for adopting the interview technique in addition to the questionnaire for this survey is specially that most of the mine owners, being completely or partially illiterate, were not capable to perceive the theme and ideology of virtual teams. Therefore, the questions from the same questionnaire were asked to them orally and then explained informally so that they could be better able to respond precisely. The purpose of this survey (both questionnaires and interviews) was to highlight various advantages associated with virtual teams in mining sector of Pakistan.

The questionnaire: This questionnaire is composed of 20 close-ended questions based on positive statements each stating one advantage associated with the virtual teams in mining sector of Pakistan. This set of 20 questions include statements e.g. virtual teams are source of cost reduction, work beyond limitations of time and space, competitive advantage, faster response to the task, better outcomes, higher efficiency and effectiveness of teams, virtually uniting experts, effective R&D decisions, greater degree of members' freedom and cohesion, greater client satisfaction, rapid decision making, self assessment opportunities to its members, improved communication and easy accommodation of personal and professional lives etc. as compared to the conventional teams. The set of questions related to advantages of virtual teams is taken from the research work of Ebrahim, Ahmad & Taha[36]. The questionnaire is attached as Appendix-1.

Each questionnaire required responses on the 5 point Likert scale. 1 corresponds to strongly agree, 2 correspond to partially agree, 3 correspond to neither agree nor disagree, 4 correspond to partially disagree and 5 correspond to strongly disagree.

Population and sample: This research was mainly focused to two main entities related to the field of mining engineering. The first one is the technical professionals (including mining engineers and supervisors) working in the field or in different (mining related) institutes and the second entity is the mine owner, an investor in most of the cases, who has the final control of finance and administration. Unfortunately, mining field is not the dream field for a professional, while on the other hand; mine owners are mostly illiterate and have been operating their mines with a layman approach. This leads us to a situation where there is a shortage of the availability of the technical skilled professionals in huge quantity (as compared to the number of professionals in electrical or mechanical engineering fields).

As there is no clear practical example of virtual teams in the mining sector of Pakistan, therefore, sample selection criteria was not as simple as "anyone related to the mining field", instead three different interest groups were made to take opinions regarding virtual teams. These groups were technical (mining field) professionals, technical experts and mine owners/ general management.

The criteria for choosing these three entities were as follows: i. For technical professionals the person must either be a mining engineer (with 5 years experience or more), associate mining engineer (with 5 years experience or more) or some non-qualified person having an experience of 7 years or more in the field of mining engineering. ii. For mine owners, the criteria was either to have a mine with high monthly production (e.g. more than 1,000 tons per month in case of dimension stones) or having two or more active mines of a single or different minerals, metal or materials. iii. For experts and researcher, the main criterion was education. Luckily, Allah has blessed mining sector with a fairly good number of competent research scholars. For this research the criterion for an expert was having an education of M. Sc. Mining engineering or higher. For researcher category the qualification of M. Sc. Mining engineering (in process) was chosen as the criterion.

Sampling method, size and data collection process: Snowball (also called chain) sampling technique was used in this research. A few prominent entities were identified and contacted first though telephonic (audio) calls and then through e-mail to fill the questionnaire and also to identify further participants. Following entities (persons) were contacted first to identify further professionals, experts and mine owners. i. Chairman department of Mining Engineering-UET Lahore, for his personal response and to approach faculty members and researchers (expert and researcher category). The expected outcomes (as pointed by this entity) were 10 who fulfill all of the set criteria. ii. Semester coordinator, department of Mining Engineering-UET Peshawar, for his personal response and to approach faculty members and researchers (expert and researcher category). The expected outcomes were 5 who fulfill all of the set criteria. iii. General Secretary, Institute of Mining Engineers - Pakistan, for his personal response and to identify and approach mining engineers and supervisors (senior and

qualified technical professionals' category). He was requested to identify and collect responses from at least 20 members who fulfill all of the set criteria. iv. President, Mine Owners Association Khyber Pakhtunkhwa, for his personal response and to identify and approach mine owners (from KP or other province), either renowned in their sectors or working in more than one sector of mining. He forwarded the complete list of all members of association, but most of these mine owners do not fulfill the set criteria.

Besides this some other entities (from government departments- i.e. Directorate and Inspectorate of Mines and Minerals) were also approached to collect their valuable responses to the questionnaire.

Responses, in the form of filled questionnaires, were collected through e-mails. Some of the experts were also requested to fill and submit these questionnaires. Despite the fact that such experts had strongly committed to do the best in this regard, they were unable to submit these questionnaires on time because of their very busy schedules (most of these had to visit remotely located sites during this period).

Most of the remotely located site supervisors had no access to the internet; however, they were requested to be approached during some free time so that the responses could be collected through a telephonic well structured interview a two-way conversation providing feedback[37] to clarify any ambiguity or complexity of the interviewee about the directions and interrogatory statements. It helps researcher to investigate the vague responses optimally.

Unfortunately, most of the mine owners have no email addresses. Most of the mine owners also have no idea about virtual teams and the information required from them. Besides, one of the main reasons why mining contributes least to the country's GDP is the least tendency of mine owners and investors to pay taxes to the government. One of the misperception of mine owners regarding this survey was the collection of all data of mine owners and their mining activities (by the government) so that they could be brought into the tax net in the near future.

The base of this misperception was mainly because Mineral Directorate of Khyber Pakhtunkhwa (KP) has started collecting data about all mining activities performed in the province. Hence the actual number of outcomes from mine owners was very much less than expected number of outcomes from this entity. Therefore, some of the responses were collected after face-to-face well structured interviews (as these interviews were based on the questions included in the questionnaires).

Finally total 30 respondents (completely fulfilling the set criteria) responded to the questionnaire. Although the sample is a little one, all of the three entities fully represent the population. The respondents were belonging to different sectors of mining (including both surface mining and underground mining). Similarly, mine owners also belonged to the mines of different minerals or materials. The expert category of respondent was also diverse as these respondents belonged to different universities. All of these categories have respondents from different geographical and cultural area thereby making the sample a good representative of actual population.

Following test statistics are used in this research study to test the dispersion/ tendency of data and symmetry of curve:

Maximum value: It is the highest number on Likert scale responded by any of the respondents against a question. As each question is based on positive statement, maximum value of 2 indicates that there will be no disagreements to the statements and hence all respondents agree.

Minimum value: It is the lowest number on Likert scale responded by any of the respondents against a question. As each question is based on positive statement, minimum value of 4 indicates that there will be no agreements to the statements and hence all respondents disagree.

In this research maximum value is the first parameter to prioritize the advantages of virtual teams in mining sector of Pakistan.

Arithmetic mean: It is the arithmetic average of all values corresponding to a variable. If there is no outlier entry, mean value is an indicator of the tendency of data. Lower mean value shows that there are more entries of lower value (e.g. 1 and 2 in this research case) and vice versa. Lower mean value indicates that more respondents are agree with the statements on the advantage of virtual teaming in Pakistan mining sector and few respondents disagree with the statements made in the questions of research study.

Median: Median value gives an overview of choice selected by most respondents for a given question. Median is truly the middle of dataset. Median value of 1 indicates more tendencies of responses in agreement to the statements made in each question of this research study.

Skewness: Skewness characterizes the degree of asymmetry of a distribution around its mean. If skewness value lies in the range of +0.5 to -0.5, the data is fairly symmetrical. For skewness value larger than 0.5 or smaller than -0.5, the data is asymmetrically distributed or skewed. Positive value of skewness greater than 0.5 (positive skewness) is an indication that more responses on Likert scale are lower than mean value. Negative skewness values lesser than -0.5 means more responses on Likert scale are higher than mean value.

Kurtosis: High kurtosis (values greater than zero) in the data set is an indication of heavy tails or outliers. Low kurtosis (values lesser than zero) in the data set is an indication of light tails or lack of outliers.

Results and discussion

The reliability factor of the set of questions related to the advantages associated with the virtual teams in mining sector of Pakistan asked in this survey is 0.816 which shows good internal consistency between all questions of the questionnaire.

There were 20 questions in the questionnaire regarding the advantages of virtual teaming related to mining sector of Pakistan. The value of different parameters (mean, median, skewness, kurtosis, maximum value, minimum value and range) calculated from the data, obtained from 30 respondents is shown in tables 1 to 4.

All of the 30 respondents were agreed (selected either of the options strongly agreed and agreed) on the statement presented in question 18 as the maximum value of any entry responded to this question is 2. Mean value of the responses against this question is 1.67 while median value is 2. Therefore the advantage stated in question 18 is the highest advantage associated with the virtual teams which is virtual teaming allows its members to be the part of multiple project simultaneously and to move from one project to another successively.

Table-1: Value of different parameters for questions 1-5 (advantages associated with virtual teams in mining sector of Pakistan).

Parameters	Values for each question				
	Q1	Q2	Q3	Q4	Q5
Mean	1.50	1.57	1.93	1.73	2.40
Median	1.00	1.00	2.00	1.00	2.00
Skewness	1.66	1.40	0.76	1.16	0.37
Kurtosis	2.59	1.41	1.75	-0.01	-1.08
Minimum value	1	1	1	1	1
Maximum value	4	4	4	4	4
Range	3	3	3	3	3
SD	0.777	0.817	0.691	1.048	1.070
Outliers	Nil	Nil	Nil	Nil	Nil

Table-2: Values of different parameters for questions 6-10 (advantages associated with virtual teams in mining sector of Pakistan).

Parameters	Values for each question				
	Q6	Q7	Q8	Q9	Q10
Mean	2.77	1.70	1.97	1.77	2.30
Median	2.00	2.00	2.00	2.00	2.00
Skewness	0.77	0.39	0.79	1.03	1.01
Kurtosis	-0.75	-0.61	0.44	2.79	0.98
Minimum value	2	1	1	1	1
Maximum value	5	3	4	4	4
Range	3	2	3	3	3
SD	0.935	0.651	0.850	0.679	0.750
Outliers (total/ actual value)	Nil	Nil	Nil	Nil	Nil

Table-3: Values of different parameters for questions 11-15 (advantages associated with virtual teams in mining sector of Pakistan).

Parameters	Values for each question				
	Q11	Q12	Q13	Q14	Q15
Mean	2.80	1.70	1.63	3.20	2.77
Median	2.50	2.00	1.00	4.00	2.00
Skewness	0.42	1.09	0.75	-0.56	0.09
Kurtosis	-0.75	1.62	-0.84	-0.74	-1.39
Minimum value	1	1	1	1	1
Maximum value	5	4	3	5	5
Range	4	3	2	4	4
SD	1.095	0.750	0.765	1.157	1.194
Outliers (total/ actual value)	Nil	Nil	Nil	Nil	Nil

Table-4: Values of different parameters for questions 16-20 (advantages associated with virtual teams in mining sector of Pakistan).

Parameters	Values for each question				
	Q16	Q17	Q18	Q19	Q20
Mean	2.67	1.70	1.67	1.70	2.20
Median	2.00	1.00	2.00	2.00	2.00
Skewness	0.92	1.43	-0.74	1.05	0.88
Kurtosis	-0.34	1.34	-1.55	0.92	0.85
Minimum value	1	1	1	1	1
Maximum value	5	4	2	4	4
Range	4	3	1	3	3
SD	1.061	0.952	0.479	0.794	0.805
Outliers (total/ actual value)	Nil	Nil	Nil	Nil	Nil

After scrutinizing data on the basis of maximum value, the main statistics for comparison of different advantages associated with virtual teams are the mean and median values.

Question 1 and 2 has the least mean values of 1.50 and 1.57 respectively. Question 7 and 13 have the maximum value of 3 which means there is still no agreements made by the respondents to the statements made in these questions. Mean value of responses against question 7 is 1.70 while that of question 13 is 1.63. Median values of question 7 and 13 are 2 and 1 respectively. Median value of 1 for question 13 indicates that more respondents are strongly agreed to the statements made in this question as compared to the median value of 2 for question 7 where fewer respondents are strongly agreed to the

statement. That's why mean value for question 13 is lower (1.63) as compared to the mean value of question 7 (1.70). While considering the skewness values, question 7 has skewness value of 0.39 while question 13 has skewness value of 0.75 which shows that data is symmetrically distributed for question 7 while asymmetrically clustered towards the lower value (1 and 2) for question 13.

Hence 2nd most perceived advantage of virtual teams in mining sector of Pakistan is the one stated in question 13 which is virtual team members are more synchronized and more in agreement beyond as compared to traditional team members.

3rd most perceived advantage of virtual teaming in Pakistan mining sector is the one stated in question 7 which is virtual teaming generally unites field experts digitally beyond geographical limitations which otherwise faced by traditional team.

All remaining questions have maximum value of 4 and 5. We cannot distinguish 4th and 5th most perceived advantages just on the basis on maximum value. So we need to consider mean values. Mean value of questions 1 and 2 are 1.50 and 1.57 respectively while for 12 and 17 it is 1.70 each. Lower mean values of question 1 and 2 indicate presence of more entries of lower values and more agreements to each statement than disagreements. Comparatively question 1 has lower mean value and more agreements to the statement than question 2. For further explanation consider the median values of question 1 and 2 which are both 1. Here in this case median cannot make clear distinction. Now consider skewness values of questions 1 and 2 which are 1.66 and 1.40 respectively. Positive values show clustering of data towards lower side of Likert scale responses, however, question 1 has higher skewness value than question 2 which reflects more clustering on the lower side for question 1 as compared to question 2. If we consider the Kurtosis values for question 1 and 2, these are 2.59 and 1.41. Mean, Skewness and Kurtosis values indicate higher frequency of strong agreements to the statement made in question 1 as compared to question 2.

Hence 4th most perceived advantage associated with virtual teams in mining sector of Pakistan is one stated in question 1 which is virtual teaming reduces the cost (e.g. accommodation and traveling etc.) compared to traditional teams. 5th most perceived advantage is one stated in question 2 which is virtual teams operate beyond the time, geographical or organizational constraints which otherwise affect traditional teams.

Appendix-1

Each of Q. 1 to Q. 20 is about advantages of a virtual team[36]		Strongly agree (1)	Agree (2)	Neither agree nor disagree (3)	Disagree (4)	Strongly disagree (5)
1	Virtual teaming reduces the cost (e.g. accommodation and traveling etc.) compared to traditional teams					
2	Virtual teams operate beyond the time, geographical or organizational constraints which otherwise affect traditional teams.					
3	Virtual teams generate the greatest competitive advantage such as improved productivity of its employees.					
4	Virtual teams respond quickly as it allows flexible daily working schedule for its employees					
5	Virtual team yields improved productivity, and workers' satisfaction)					
6	Virtual teaming offers higher team effectiveness and efficiency					
7	Virtual teaming generally unites field experts digitally beyond geographical limitations which otherwise faced by traditional team					
8	Virtual team makes R&D decisions more effectively.					
9	Virtual team members working on development projects feel more freedom.					
10	Virtual team offers greater productivity through shorter development times					
11	Virtual team offers greater client satisfaction					
12	Virtual team is useful for projects that require cross-functional or cross boundary skilled inputs					
13	Virtual team members are more synchronized and more in agreement beyond as compared to traditional team members.					
14	Virtual team makes decisions effectively and quickly.					

15	Virtual teaming enhances self-assessment opportunities to individual workers					
16	Virtual teaming optimizes its members' inputs to successfully complete business activity aligned with organizational goal					
17	Virtual teaming improves inter-organizational communication and harmony, and enhances resource sharing.					
18	Virtual teaming allows its members to be the part of multiple projects simultaneously and to move from one project to another successively.					
19	Employees can more easily manage work-family balance					
20	Virtual teams have more associated advantages than disadvantages.					

Conclusion

This study infers that virtual teams are advantageous for both the technical professionals and mine investors. Virtual teams can offer technical professional to be the part of multiple projects simultaneously and avoiding the social cutoffs. These teams also allow mine investors to avail the services and utilize the expertise and experience of technical experts from across the globe. Virtual teams are also helpful for mine owners as a source of cost reduction as compared to the traditional teams. Hence, virtual team is an optimum option for the mining organizations to produce mineral commodities on cost effective models simultaneously utilizing the best available talent from across the globe. In this way these organizations can compete nationally as well as globally.

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