ABSTRACT

1. Introduction:
Manpower management is one of the most challenging tasks the business world is facing today. Added to that is the knowledge management which has assumed stupendous proportions due to the fast pace at which the technology is changing today and has never been witnessed before. The problems generated by these two get compounded in case of heavy industries like Steel sector, wherein the initial investments are huge and to encounter the fast changing technology additional expenditure become almost prohibitive. Under the conditions these industries have to be on the constant guard to chalk out well planned strategy to face the challenges and devise systems that can continually adapt themselves to the changes, the industrial environment subjects them.

Bhilai Steel Plant, an integrated steel plant, has been facing the said challenges, almost from the day of its inception. It was originally conceived and set up as a unit that generates huge employment potential in the country. Subsequently with the advent of liberalization and globalisation the focus of attention shifted to making it a business unit and emphasis also shifted to profit generations rather than the earlier ideological functions of creation of employment that would meet primarily the government's political objectives. The first axe fell on manpower size and rationalization became imminent to make them a profit oriented unit.

The important role of management emerges here. While reducing the manpower one needs to see that knowledge drain is not allowed to take place. Therefore, Knowledge Management and steps required for retention of knowledge which is embedded in the minds of the persons became a necessity.

Importance of KM:
Knowledge Management, in recent times, has become one of the most fascinating subjects not only for its richness in exploratory field area for educationists, but turned out to be the most profitable proposition for the practitioners as well. Industries, irrespective of their size, started to realize the importance of the subject, the advantages of approaching the subject in an organized manner, and also the perils of ignoring it. While undoubtedly its impact is immediately felt in small knowledge
intensive firms, larger firms take longer time to come to realization and perhaps by that time the damage might have crept into the system.

**BSP as the domain of study:**

Bhilai Steel Plant has been taken as the domain of present research study with the following objectives:

- Approach to Knowledge Management by BSP
- KM status at BSP
- Measures taken by BSP for its implementation
- Understand how people think about Knowledge Management
- Analyse the performance of BSP with respect to KM implementation
- Identify KM success factors at BSP
- Suggest steps needed for further improvement of KM performance at BSP

The study after going into the details as enumerated above will mainly identify the success factors, which then could be applied in other plants as well to get the benefits of KM implementation.

2. **Literature Survey:**

There has been a virtual deluge of literature on this subject beginning in the last decade of last century. Great management visionaries and gurus like Peter F. Drucker, portended that the traditional factors of production - land, labor, and capital - are becoming restraints rather than driving forces. Knowledge is becoming the one critical factor of production. It has two incarnations: Knowledge applied to existing processes, services, and products is productivity; knowledge applied to the new is innovation. Besides this, many people came up with different definitions, different theories and so on. The number of great authors is myriad but few of them are Davenport, T. H. and Prusak, L.; Nonaka, I. & Takeuchi H.; M. H.; Polyani, M. Skyrme, D.; Wendi R. Bukowitz & Ruth L. Williams; Elias M. Awad & Hassan M. Ghaziri; Amrit Tiwana; Etienne Wenger and Malhotra, Y.

Extensive literature survey on knowledge management was done during the study and it broadly covered following points:

- Strategy and Frame work for Knowledge Management:
- Critical Factors in The Successful Implementation Of Knowledge Management:
3. Research Methodology:
The research study is conducted in two phases. The first phase dealt with developing an appropriate research framework with facts and theories accessed from literature survey on Knowledge Management, the library and archives of BSP, various journals and books and also through internet access.
In the second phase of the study, people from various departments of BSP have been approached with framed questionnaire. Sample population was limited to senior executives (E-5 to E-8), executives (E-0 to E-4) and top most grade of N-11 people in the non-executive level. Research approach was Survey Research, through the use of structured questionnaire and Interviews.

Objectives of research are:

- To analyze the practices of KM at BSP
- To analyze the performance of KM at BSP
- To ascertain the sufficiency within the plant to meet to the fast paced future challenges.
- To identify the factors those were responsible for successful implementation of KM.
- To identify gaps if any.
- To suggest steps for improvement.
- BSP being a part of SAIL, the results arising from the above points could subsequently be applied to other units of SAIL as well.

The scope of present work covered collection of data from the sample BSP collective through survey and questionnaire method, based on the assumed hypotheses. Two sets of questions have been prepared.

The statistical tools have been applied on to the data to get output and then attempted to draw conclusions and suggestions.

Survey Instrument was basically questionnaire method to collect the data. Statistical analysis was done using ANOVA, Regression analysis, Factor analysis, reliability tests, and descriptive statistics.

The first set of questions was prepared based on the previous studies conducted in-house by BSP and these were scrutinized by experts of BSP in the field of Knowledge Management.

For preparing the second set of questions, guidance from the book “The Knowledge Management Fieldbook”, authored by Wendi R. Bukhowitz and Ruth L. Williams was taken.

Data source for responses to the questions has been the Bhilai Steel Plant personnel themselves. For secondary data, the archives of BSP, various libraries, books,
journals, internet, colleges and other such avenues were approached where the data and information was available. The sample for carrying out the analysis has been decided from the BSP people only.

Sampling unit has been taken from various departments of BSP but the sample population was limited mostly to executives and one senior most grade from non-executive level. Sample size has been decided accordingly. The total size of the sample unit being around 5300, a sample size of about 450 to 500 was considered to be a fair representation. The total valid responses worked out to be 427.

The sampling was based on systematic random sampling. Firstly, the names of the total population of all the departments were collected in the above mentioned categories from the BSP. The names were picked up at regular intervals. The interval was decided by dividing the total population number by the estimated sample size.

The hypotheses were developed from the following three major categories. These are:

- Employee related factors,
- Organizational related factors and
- System related factors.

Further for the success of KM, following factors were considered essential and hence these were also taken into account:

- Time spent towards KM and
- Value of KM to people.

Hypotheses covered points like information exchange, information availability, learning from failures, support from management etc.

The present study has following limitations.

- The study is limited to Bhilai Steel Plant only.
- The sample of BSP collective included samples from Senior Executives (from E-5 to E8 grades), Executives (from E0 to E4 grades) and Non-executives (from N-11 grade only). Samples from people below this grade were not taken due to the educational limitations and the nature of jobs they carry out. Persons in ED grade and MD were not taken as they are the highest authorities.
- The period the study covered is from the starting point of KM implementation at BSP, that is, around year 2002 till 2008.
4. Data, Analysis and Discussion of Survey Results:
The data collected through procedure as stated above was compiled and appropriately tabulated. For the analysis of collected data help of EXCEL and SPSS software version 16.0 was taken to use standard statistical techniques. In the first set there are 27 questions. These have been subjected to ANOVA test to find if there is any variance in the opinions expressed by different categories of respondents, namely, Senior Executives, Executives and non-executives. The first set of questions are so framed as to get information about BSP on the following broad points, namely, devotion of time, values given by collective to the KM, information availability and management support and to test the awareness of BSP employees about Knowledge Management.

The results of the 2-way ANOVA technique indicate that the differences in responses are not significant across non-executives, executives and senior executives. In other words, the level of awareness about KM is equally good across the three groups. This implied that there is no need to differentiate between these 3 groups of employees during further analysis, especially for the second set of questions.

In the second set, 60 questions were put up, and sample BSP collective have been asked to mark responses on a five-point scale. Based on the responses, weighted %s have been calculated and the overall responses by BSP collective exhibited excellent awareness of the subject of KM. While the weighted score of more than 60% for almost all the questions in the second set indicate the excellent general awareness of entire BSP collective on the subject of KM and the agenda for action requiring special attention is limited to only few areas of questions that comparatively scored less weighted %s as compared to the other questions. Notable among them are question numbers 2, 3, 8, 33, 35, 42, 43, 45, 48 & 59.

Following hypotheses were developed based on which questionnaire subsequently drafted:

a) Hypotheses based on Employee related factors:
   1. Information Exchange among Employees is positively related to Value of KM to Employee.
   2. Learning from failures in organization is positively related to Value of KM to Employee.
3. Information Exchange among Employees is positively related to Time spent on KM by Employee.
4. Learning from failures in organization is positively related to Time spent on KM by Employee.

b) Hypotheses based on Organization related factors:

1. Information Availability in organization is positively related to Value of KM to Employee
2. Information Availability in organization is positively related to Time spent on KM by Employee
3. Organization Support and encouragement is positively related to Value of KM to Employee.
4. Organization Support and encouragement is positively related to Time spent on KM by Employee.

c) Hypotheses based on System related factors:

1. IT and System Support in organization is positively related to Value of KM to Employee.
2. IT and System Support in organization is positively related to Time Spent on KM.
3. The value of KM is positively related to the Time spent.

The 2nd sets of questions were subjected to factor analysis to get loaded factors. Five factors were obtained and these were tested for reliability and through regression analysis tried to be related to two dependent variables, namely time and value. The outcome and results of factor analysis are given as below. Kaiser-Meyer-Olkin Measure of Sampling Adequacy of 0.564, which is more than 0.500 is considered alright.

From the outcome of the factor analysis, it is observed that five factors influence KM success, namely:

1. Information Exchange among employees,
2. Ability of Employees to learn from failures,
3. IT support provided by the organization,
4. Availability of information to all the employees and
5. The support provided by the management for practicing knowledge management.

These factors were tested for their reliability using reliability analysis tool in SPSS 16.0. The results of the analysis are:

<table>
<thead>
<tr>
<th>FACTOR</th>
<th>CRONBACH'S ALPHA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Information Exchange</td>
<td>0.757</td>
</tr>
<tr>
<td>Learning from Failures</td>
<td>0.712</td>
</tr>
<tr>
<td>IT Support</td>
<td>0.676</td>
</tr>
<tr>
<td>Information Availability</td>
<td>0.623</td>
</tr>
<tr>
<td>Organization Support</td>
<td>0.619</td>
</tr>
</tbody>
</table>

An attempt was made to relate the identified factors to indicators of success of KM. Basically two indicators of KM success were analyzed taking from 1st set, namely, Value of KM to employees and time spent by employees on KM.

To conduct the analysis Multiple Regression Technique was used.

i) Relating the identified factors with the Value of KM to employees:
The results show that information exchange and information availability are two important factors that influence value of KM to employees. It is obvious that if the information exchange (t-value=7.21, p-value=0.00) and information availability (t-value=4.07, p-value=0.00) is greater, it would promote the value of KM among the employees. The coefficient of determination is 0.172, which means that the model explains 17.2% of variation in value of KM to employees.

ii) Relating the identified factors with the Time spent by the employees on KM:
The results show that value (t-value=5.803, p-value=0.00), learning from failures (t-value=2.478, p-value=0.014) and support provided by the organization (t-value=4.170, p-value=0.00) are important factors that influence time spent on KM by employees. However, the influence of information availability is negative (t-value=-3.006, p-value=0.003), which means with the information readily available and in an organized way, people do not have to start from the first principle or waste much time in searching. The coefficient of determination is 0.15, which means that the model explains 15.0% of variation in time spent on KM by employees.
5. Results of the hypotheses:

Based on the results of application of the statistical tools, the following are the hypotheses results. Results of the hypotheses tested are placed in the tabular form below:

Criteria for acceptance: t-value has to be >1.96 and p-value has to be <0.05

<table>
<thead>
<tr>
<th>No.</th>
<th>Hypothesis</th>
<th>t-value</th>
<th>p-value</th>
<th>Result</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td><strong>Employee related factors:</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>Information Exchange among Employees is positively related to Value of KM to Employee.</td>
<td>7.21</td>
<td>0.00</td>
<td>Accepted</td>
</tr>
<tr>
<td>2</td>
<td>Learning from failures in organization is positively related to Value of KM to Employee.</td>
<td>0.33</td>
<td>0.75</td>
<td>Rejected</td>
</tr>
<tr>
<td>3</td>
<td>Information Exchange among Employees is positively related to Time spent on KM by Employee.</td>
<td>1.380</td>
<td>0.168</td>
<td>Rejected</td>
</tr>
<tr>
<td>4</td>
<td>Learning from failures in organization is positively related to Time spent on KM by Employee.</td>
<td>2.478</td>
<td>0.014</td>
<td>Accepted</td>
</tr>
<tr>
<td></td>
<td><strong>Organization related factors:</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>Information Availability in organization is positively related to Value of KM to Employee.</td>
<td>4.07</td>
<td>0.00</td>
<td>Accepted</td>
</tr>
<tr>
<td>2</td>
<td>Information Availability in organization is positively related to Time spent on KM by Employee.</td>
<td>-3.006</td>
<td>0.003</td>
<td>Accepted</td>
</tr>
<tr>
<td>3</td>
<td>Organization Support and encouragement is positively related to Value of KM to Employee.</td>
<td>1.88</td>
<td>0.06</td>
<td>Rejected</td>
</tr>
<tr>
<td>4</td>
<td>Organization Support and encouragement is positively related to Time spent on KM by Employee.</td>
<td>4.17</td>
<td>0.00</td>
<td>Accepted</td>
</tr>
<tr>
<td>System related factors:</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>------------------------</td>
<td>---</td>
<td>---</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1 IT and System Support in organization is</td>
<td>0.09</td>
<td>0.93</td>
<td>Rejected</td>
<td></td>
</tr>
<tr>
<td>positively related to Value of KM to</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Employee.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2 IT and System Support in organization is</td>
<td>0.113</td>
<td>0.910</td>
<td>Rejected</td>
<td></td>
</tr>
<tr>
<td>positively related to Time Spent on KM.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>The Value of KM is positively related to the</td>
<td>5.803</td>
<td>0.00</td>
<td>Accepted</td>
<td></td>
</tr>
<tr>
<td>Time spent.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Going by the above analysis, it can be concluded that BSP can lay more emphasis on the factors where the hypotheses got accepted, as they can enhance contribution to the success of KM. The study reveals that the other factors do not have any significant relationship and hence it is considered that those factors may not be able to contribute much towards KM.

Descriptive statistics of the variables of each of the five factors obtained through factor analysis indicate the normality of data.

6. Summary and Conclusions:

It is noted that BSP embarked upon the implementation of KM in all earnestness in the year of the turn of the century, gradually built up teams, identified experts who facilitated creation of knowledge teams and task forces, knowledge workers, imparted the knowledge of basic theory behind the KM, organized creation of domains, sub-domains, earmarking the responsibilities and initiatives required to be undertaken by team leaders. They created various communities of practice with CoP champions and CoP coordinators so that all main units of the plant are covered. BSP intranet was created where people can post their knowledge pieces.

It is also observed that:

- BSP is a continuously profit earning unit making enormous profits from 2001 onwards giving an indication of its capability and expertise.
• It has followed systematic and phase-wise investments so that interest and
depreciation burden does not affect profits beyond control or limit, as
happened with other sister steel plants like Durgapur Steel Plant for instance.
• BSP has been breaking all the production records and improving techno-
economic parameters consistently over the years and got several awards in all
fields of activities, prominent being Prime Minister's Trophy seven times.
• At BSP, though the man-power has drastically reduced over the years from
about 54,000 to about 34,000, the effect of the same is not visible on the
performance parameters.
• Major techno-economic parameters on all fronts like general plant
performance, steel melt units and rolling mills, show a continual improvement
surpassing best figures year by year, every year. This indicates the innate
strength of BSP in its systems, practices, policies and the frame work in which
it executes its responsibilities.
• BSP's visionary capacity can be judged by the way it has chalked out its future
road map for expansion, indicating its readiness to take the advantage of
congenial market conditions.
• The way KM implementation was done at BSP draws us to infer that BSP has
the necessary sound infrastructure for successful KM implementation.

7. Interpretation of Results through simple analysis using weighted percentages:
The present research study was made through obtaining responses to a variety of
questionnaire, all depicting to various facets of KM implementation and sustained
practice. About 90 questions were asked to be answered dividing them into two
different sets. The basic idea behind this was to ascertain how much people were
aware of KM and how much they realize its importance, its benefits to the company.
Inference and interpretation of answers to the questions, the overall picture & main
findings are:
• People at BSP are aware of the advantages of KM implementation
• People at BSP understand the basic tenets of KM.
• They know what has to be learned what has to be un-learned and the timings
of these learnings and un-learnings.
The weighted score of more than 60% for almost all the questions in the second set, numbering about sixty indicate the excellent general awareness of entire BSP collective on the subject of KM and the agenda for action requiring special attention is limited to few areas of questions that comparatively scored less weighted %s as compared to the other questions. Notable among them are question numbers 2, 3, 8, 33, 35, 42, 43, 45, 48 & 59. These are:

**Weighted % of Identified questions that need attention:**

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Question No.</th>
<th>Question Description</th>
<th>Weighted Score %</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2</td>
<td>People routinely share their expertise and document as well.</td>
<td>62</td>
</tr>
<tr>
<td>2</td>
<td>3</td>
<td>There are systematic processes to share knowledge.</td>
<td>63</td>
</tr>
<tr>
<td>3</td>
<td>8</td>
<td>Communities of specialists are easily accessible to those who seek information.</td>
<td>62</td>
</tr>
<tr>
<td>4</td>
<td>33</td>
<td>People in BSP do not believe that sharing their knowledge reduces their value in the organization.</td>
<td>63</td>
</tr>
<tr>
<td>5</td>
<td>35</td>
<td>Knowledge sharing behaviour is reflected in performance appraisal system.</td>
<td>60</td>
</tr>
<tr>
<td>6</td>
<td>42</td>
<td>BSP has methods to measure and it measures Knowledge Management Processes and their results.</td>
<td>63</td>
</tr>
<tr>
<td>7</td>
<td>43</td>
<td>KM activities have links to measurable results.</td>
<td>62</td>
</tr>
<tr>
<td>8</td>
<td>45</td>
<td>External and internal documents are issued indicating how well BSP manages knowledge.</td>
<td>62</td>
</tr>
<tr>
<td>9</td>
<td>48</td>
<td>Qualitative and quantitative metrics to gauge effectiveness of KM processes and results are established at BSP.</td>
<td>61</td>
</tr>
<tr>
<td>10</td>
<td>59</td>
<td>Promotion policies are reviewed with a view to ensure knowledge retention.</td>
<td>57</td>
</tr>
</tbody>
</table>

The statements mentioned in the above ten questions, having obtained comparatively lower weighted response score percentages as compared to other questions, need to be addressed suitably by the top management so that the continued interest and alignment towards KM remains in the minds of the people.

8. Interpretation of Results based on Statistical Analysis using EXCEL and SPSS-16.0:
ANOVA applied to 1st set of 27 questions indicated that the differences in responses are not significant across non-executives, executives and senior executives. In other
words, the level of awareness about KM is equally good across the three groups. This implied that there is no need to differentiate between these 3 groups of employees during further analysis, especially for the second set of questions.

From the second set of questions, about seventeen questions were taken for conducting factor analysis and five constructs were obtained. These 17 questions are clearly loaded on individual factors with loading greater than 0.400.

Questions, V1, V2, V6, V7 and V8 were loaded together. These questions attempt to measure the information exchange that takes place amongst BSP employees (Factor-1).

Questions V24, V25 and V26 were loaded together on Construct 2. These questions attempt to measure the employees' ability / desire to learn from failures.

Questions V52, V53, V54 and V56 were loaded together on Construct 3. These questions attempt to measure the IT support provided by the organization for practicing KM.

Questions V4 and V5 were loaded together on Construct 4. These questions attempt to measure the information availability in KM platform.

Questions V3, V34 and V35 were loaded together on Construct 5. These questions attempt to measure the support provided by the organization for practicing knowledge management.

The above five factors were tested for their reliability using reliability analysis tool in SPSS 16.0. The results of the analysis show that CRONBACH'S ALPHA is 0.757, 0.712, 0.676, 0.623 and 0.619 respectively for the five factors.

Further, analysis was done by attempting to relate the identified factors to indicators of success of KM. Basically two indicators of KM success were analyzed in set 1, namely,

- Value of KM to employees and
- Time spent by employees on KM.

Naturally, if KM is successful in an organization, it should be reflected by increase in time spent by employees on KM and their valuing of KM. And through the success of KM company is expected to derive its pride place in the industrial fraternity.

For conducting the analysis Multiple Regression Technique was used and the details were projected in earlier paragraphs of this abstract.

9. Findings:

1. From the general observations and inferences, it is seen that BSP has a unique position in all fields of activities including successful implementation of KM Practices.
2. From the analysis of 1st set of questions, it is seen that there is an excellent, equal and common awareness about KM in all groups of BSP collective.

3. From the analysis of 2nd set of questions, following factors are identified that can enhance contribution to the success of KM:
   - Information Exchange among Employees is positively related to Value of KM to Employee.
   - Learning from failures in organization is positively related to Time spent on KM by Employee.
   - Information Availability in organization is positively related to Value of KM to Employee.
   - Organization Support and encouragement is positively related to Time spent on KM by Employee.
   - The Value of KM is positively related to the Time spent.

In addition, from the general observation, it is also seen that BSP collective needs additional attention in the following areas as well to reap the benefits of KM implementation:
   - Sustained interest and monitoring at all levels including from top management as well.
   - Regular reviews.
   - Sustained encouragement.
   - There has to be proper recognition for the persons doing good work in the field of KM.
   - Recognition of such people or groups by way of awards will go a long way.
   - Suitable and better way of recognition to the contributors of good knowledge pieces is needed, which should be different to what is done with suggestion schemes, quality circles and other such schemes.
   - Task force also needs motivation such that they feel proud to implement KM in the plant and are made aware of the value of their contribution to the company through their efforts to cover the entire BSP collective in KM practices.
• Formation of dedicated task force or department exclusively for KM can be one of the steps to stem the waning of interest. At TISCO, a separate department was formed with a staff that exclusively not only monitors KM implementation but also facilitates promotion of the same. They hold the total responsibility for every thing connected with the subject. (TISCO website accessed through internet, January 2008).

• Integration of KM in to the daily routine activities such as production, maintenance, quality assurance can be monitored by this exclusive department or group. Just as through suitable incentive bonus schemes, encouragement is given to all the BSP collective to excel in productions, quality etc., similar efforts can be implemented in KM field as well.

• Benefits accruing to the company out of posted knowledge pieces should be tried to be quantified, well publicized and a suitable way sharing the same with the collective should also be devised.

• In such a large organization as BSP, where, compared to the % of knowledge work force, the labour intensive work force is huge, the intensity of KM implementation as such gets very much retarded and hence sustained efforts are all the more very essential.

• Even then, as many departments have knowledge work-force, their sustained interest and active participation can benefit both KM and the plant as a whole.

10. Conclusions:

Through the study, it is found that the awareness of the BSP collective about KM is at excellent level and the sample that involved three levels of the employees indicate that there is no significant difference between the levels in understanding and implications of the topic, that is, Knowledge Management.

The study has revealed five major areas that positively contribute to the success of KM implementation. From the hypotheses testing we get these areas where BSP can turn the tables by paying more attention so that ultimately through enhanced success of KM, the collective can carve a niche for itself in the steel industry fraternity.

For other sister plants of SAIL to emulate BSP, the results obtained through this study would go a long way and bring their performance levels also at par with BSP.