The practice of Business Process Re-engineering at bottom-line and its impact on Productivity: An experimental study of BSNL

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Abstract  
Most companies today practiced business process reengineering to enhance overall performance and efficiencies of the companies. Business process reengineering has been adopted by many companies in an effort to improve their competitive position and enhance their ability to provide customer satisfaction. It is also considered as one of the important necessities for the companies to fortify situation in the market. Decision for a reengineering process is usually taken up by upper level managers who enjoy authority. This research attempts to explore possibility of business process reengineering at the bottom line of the decision hierarchy of the company where there is limited authority for making decision to make change. This research will provide results of an experiment on business process reengineering undertaken at the operations level in a telecom company. It studies impact of the business process reengineering on the productivity and performance of the company with the changes made at the bottom line of the decision hierarchy. The results show that there is scope for business process reengineering at the bottom line for better productivity and performance even though there exist constraints like costs and limitation in decision. Proper resource management and sound understanding of the core competencies of technologies play an effective role in adoption of business process reengineering at bottom line.  

Keywords: business process reengineering, productivity and performance of company, bottom-line decision hierarchy, resource management, core competencies of technologies.  

1. Introduction  
Business process reengineering has been practiced in industries with diverse approaches. Companies are managed by rules and procedures established by upper-level managers. Normally, such rules are structured to solve typical problems and these rules provide less flexibility in approaches to operations. The environment of the business however does not remain constant due to intense competition and change in customers’ expectation. The firms therefore explore possible ways to compete these challenges of change and competition by reengineering the companies. Reengineering is a complex process, which requires huge expenses in terms of time to analyze the company and its processes. Decision to make changes in the business process is usually taken up by upper level managers who enjoy authority and can motivate overall reengineering effort. The gestation period for adoption and implementation of a major business process right from identification of the process and getting approval for implementation in the hierarchy of the chain of command to the implementation of the new process is often very high.  

The operations level is the bottom line decision level amongst the three primary levels of decision in business viz. operations, tactics and strategy. It consists of day-to-day operations and decision. Most of
the decisions and tasks at this level are well structured within the scope of specific rules and procedures. Redefining the process at this level even with a noble and creative thought within the existing structure of the organization is very limited. However, within the purview of internal management without involving risk of heavy costs and strategic decision but by utilizing the existing resources at this level, one may explore for reengineering process that can yield better productivity. The operational manager who enjoys limited authority over all stakeholders on decision still can lead some managerial units in the process of reengineering if he or she has passion to reinvent the company with innovative thinking. Effective utilization of resources within the domain of operations level could be focused for a reengineering process at low or no cost with the help of information technology, which is an essential enabler in any reengineering effort.

2. Literature Review

2.1 Business Process Reengineering

Organization may be viewed as a collection of many individuals, which are associated with different activities that coordinate among themselves to produce specific product or service and deliver value to the customers. Business process on the other hand is defined as a collection of activities that have inputs, which would transform to an output that has value to the customers. Michael Hammer and James Champy in their book “Reengineering the Corporation 2001” defined reengineering as the Fundamental rethinking and radical redesign of business processes to achieve dramatic improvements in critical, contemporary measures of performance, such as cost, quality, service and speed.

The keyword processes, which corresponds to the object of reengineering and natural business activities of the organization is one among the four important keywords viz. Fundamental, Radical, Dramatic and Processes of Hammer and Champy’s definition on reengineering. Most people in business normally do not give more emphasis on process even though this happens to be the most important among the four keywords and rather they focused on tasks, jobs, people and structure. The practice of task based focus with fragmentation of the tasks into simplest components and assignment to specialist workers has been a very common for quite long with little shift in process based radical thinking in business.

2.2 Resource management and core competencies of technologies

One of the hardest parts of reengineering lies in recognizing the new, unfamiliar capabilities of technology instead of its familiar ones. Staying on the top of new technology and learning how to recognize and incorporate it into an organization must be an ongoing effort. Companies must identity the technologies and their core competencies if they are to succeed in a period of ongoing technological change. Those better able to recognize and realize the potential of new technology will enjoy a continuing and growing advantage over their competitors (Hammer and Champy, 1993). Information technology, which plays a crucial role in business reengineering, is one of the valuable resources that can increase economic growth and has potential to impact on the process of productivity conversion. Implementing information technology in business is traditionally aimed at automating the pre-existing processes but in reengineering, unlike automation, it is about innovation. Information technology cannot elevate productivity unless there is innovative change in the processes through reengineering the processes in which the processes are analyzed, simplified and redesigned.

In some organizations, there may be plenty of resources and technologies but due to improper utilization of the resources, they may face waiting and wasting time, which will ultimately affect the productivity. Realization of potential of the technology and exploitation of its competencies blend with the exploration of the other resources will provide an added advantage to the reengineering process.
3. Research Conceptualization

Telecommunication industry is one among the network industries which has undergone the most dramatic changes since the mid-1980. This sector continues to register a significant growth and emerging as one of the key sector responsible for India’s resurgent economic growth. The telecom companies are continually under competitive pressures and are often forced to re-evaluate their business processes, in fact in addition to induction of new technologies. Telecommunication is a capital-intensive business in the area of rapidly advancing technologies with constant fight against obsolescence. The telecom management is therefore always on the lookout for better systems and methods which would help them achieve better performance and productivity. On the other side, the change on their way to improve performance is often negotiated with huge expenses in terms of time and money.

Bharat Sanchar Nigam Limited, BSNL is a public sector telecom company wholly owned by Government of India and it has large network of landline exchanges across the country. Basic landline phone service provided by the company prior to introduction of mobile telecom services in the country in the early 2003 and few years later was indeed remarkable. The work force engaged for operation and maintenance activities of this large network of landline exchanges was quite high. Most of the operation and maintenance activities of these landline exchanges were of routine and structured nature. In order to illustrate how effective resource management works at the operations level and what it could accomplish for a company in its effort for better productivity with the help of reengineering, an original study in the form of an experiment was carried out in Bharat Sanchar Nigam Limited, Manipur. The aim of this experimental study was to investigate the impact of business process reengineering on the productivity at the operations level of the decision hierarchy.

The billing system of landline telephones and information system of telephone exchange of BSNL, Manipur SSA were identified as area for study and experiment. The activity of disconnection and reconnection of landline numbers that involved two physical divisions, which were logically interrelated in terms of activities, was chosen for adopting innovative changes leading to development of a new process for this activity and this helped the researchers study the impact of the change on efficiency and productivity.

4. Understanding existing system

4.1 Billing system and service barring

Prior to implementation of the centralized Called Detail Record, CDR based billing system; a non-centralized C-TRA billing system was very popular in some Secondary Switching Areas, SSAs of BSNL including Manipur SSA. This billing system was exclusively used for billing purpose of landline subscribers.

The computerized- Telecom Revenue and Accounts (C-TRA) billing software system installed in Manipur SSA was used for preparation of the landline telephone bills. The opening and closing meter readings of the indicators were supplied from the exchanges. The telephone bills generated by C-TRA were distributed to the subscribers through postal department. The details of payments made by the subscribers against their telephone bills at the customer service center counters were updated to the system. On expiry of the pay-by-date i.e. due date, a list of defaulters in the form of disconnection list was printed. This disconnection list was general disconnection list and as such, many indicators belonging to certain categories of subscribers whose services should not be withdrawn irrespective of any outstanding dues were included. Some of the categories, which were to be taken care of against disconnection, were [1] exempted numbers [2] service numbers [3] numbers falling within the cut-off limit of outstanding due. Besides these categories, many numbers, which were disconnected in the last
disconnection exercise or earlier and remained as defaulters till date were also included in the list as fourth type of category. The fifth type of category was the rest of indicators from which services were to be withdrawn. Staffs were engaged at TRA disconnection unit to sort out the main disconnection list and prepare another list free from subscribers belonging to the above first three categories. On average, the size of the new disconnection list was 500 indicators per day. The fourth and fifth type of categories, which could not be taken care of by the TRA unit was addressed by the exchange staffs by enquiring the current class of service status of the individual indicators at the MMC terminal of the exchange. After sorting out the fourth and fifth categories, final disconnection list was prepared for execution through MMC command at MMC terminal. Consequent upon disconnection, the population of the subscribers who rushed to customer service centers for payment of their telephone bills leading to restoration of their services was increased.

![Figure 1: Block Diagram for Class of Service modification](image)

4.2 Service restoration

The reconnection list prepared at the customer service centers for the subscribers who cleared their outstanding dues was pre-checked by enquiring the status of class of service of the individual indicators at the MMC terminal of the exchange. Based on the status of the indicators, a final reconnection list was prepared for execution. With the help of MMC commands at the MMC terminal, the services of the telephones were restored. This way the activities of disconnection and reconnection were performed as a routine work on daily basis. The entire activity consumed lot of time on average besides involvement of many staffs. The error of wrong disconnection was very frequent particularly among the subscribers who cleared their outstanding dues after due date. This inconvenience was beyond control as indicators belonging to these subscribers had already appeared in the main disconnection list printed just after due date.
5. Introduction of New System

5.1 Initiative for new system and resource planning

Information technology tools and communication software like ProComm, Crosstalk, Hyper-terminal, and OMPC were available at telephone exchanges and customer service centers in Manipur SSA in the year 2004. The two main landline telephone exchanges, which were serving people of Manipur during those days, were E10B and OCB exchanges. Although adequate resources of information technology and other tools were available, the competencies of such tools were not explored fully and instead conventional routine procedures were largely followed in the day-to-day operations.

![Block Diagram for Class of Service Modification under New System](image_url)

In an initiative to explore competencies of the information technology tools available within the jurisdiction of TRA and telephone exchange information system, the exchange in-charge and his subordinate staffs studied the existing system and critically examined the competencies of the tools. They realized that the existing computer and communication tools supported by a software capable of processing and converting the TRA text file to database file would help them prepare command files understandable by exchange server. They believed that efficiency and accuracy of the disconnection and reconnection activities could be improved if the existing process was redesigned with information technology within the context of command files. Since, some databases files were to be involved besides conversion of the text file to database file, a source code was written for Clipper-5 compiler by Th. Sharatchand Meetei to handle certain tasks pertaining to (1) processing of TRA text file (2) management of database files and (3) preparation of command files. This internally developed software was named as IDAP version-1.
### Figure 3: TRA disconnection text file (sample)
Figure 4: Block schematic of processes involved in IDAP software
5.2 Modification of class of service

The TRA disconnection text file prepared in soft format was sent directly to exchange in-charge. This complex text file, populated with approximately 24000 indicators was processed in IDAP and converted to a database file. A command file known as MACRO was prepared from the database of the indicators by excluding indicators belonging to exempted category, service category and permissible outstanding due category. This sequence of command in the form of interrogation command file was executed in the exchange server through MMC terminal with the help of suitable communication software. The output of the interrogation command file obtained in the form of log file was processed in the IDAP and another command file for disconnection was prepared with the help of this software. This disconnection command file was executed by the exchange in-charge before leaving the office in the evening.

The command file continued to execute until late night or early morning of the next day without any human intervention. The log file saved during execution of the sequence of commands was processed in the IDAP and stored in the disconnection history database. This way disconnection of telephones of large number could be carried out on the same day of preparation of the disconnection list by TRA unit. In normal instances, the number of phones disconnected was approximately 12000, however, the
number of telephone indicators figured in the TRA list was approximately 24000. This difference in figure was due to repetition of many indicators belonging to a category, which was either disconnected in the previous cycle or closed.

The reconnection database file sent from customer service centers was converted to an interrogation command file in the software and report log file obtained after execution of the command file was processed in the software again for preparation of final reconnection command file. The final reconnection command file was executed through MMC terminal by the exchange in-charge before leaving office in the evening. The practice of manual data feeding either for disconnection or reconnection for execution of MMC commands for individual subscribers pertaining to class of service modification in the old system had been avoided in the new system.

6. Productivity and Performance Analysis

Production Function Estimation

The following table shows the number of telephones i.e. indicators disconnected per day during a period of 30 consecutive days in the old system.

<table>
<thead>
<tr>
<th>Production Period</th>
<th>Output Indicator (Q)</th>
<th>Exchange Input Hour (K)</th>
<th>TRA Input Hour (L)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>400</td>
<td>6</td>
<td>6</td>
</tr>
<tr>
<td>2</td>
<td>515</td>
<td>8</td>
<td>9</td>
</tr>
<tr>
<td>3</td>
<td>500</td>
<td>7</td>
<td>8</td>
</tr>
<tr>
<td>4</td>
<td>600</td>
<td>8</td>
<td>10</td>
</tr>
<tr>
<td>5</td>
<td>485</td>
<td>7</td>
<td>8</td>
</tr>
<tr>
<td>6</td>
<td>240</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>7</td>
<td>700</td>
<td>10</td>
<td>12</td>
</tr>
<tr>
<td>8</td>
<td>500</td>
<td>6</td>
<td>8</td>
</tr>
<tr>
<td>9</td>
<td>525</td>
<td>6</td>
<td>8</td>
</tr>
<tr>
<td>10</td>
<td>490</td>
<td>6</td>
<td>7</td>
</tr>
<tr>
<td>11</td>
<td>500</td>
<td>8</td>
<td>9</td>
</tr>
<tr>
<td>12</td>
<td>450</td>
<td>7</td>
<td>8</td>
</tr>
<tr>
<td>13</td>
<td>100</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>14</td>
<td>645</td>
<td>8</td>
<td>10</td>
</tr>
<tr>
<td>15</td>
<td>400</td>
<td>5</td>
<td>7</td>
</tr>
<tr>
<td>16</td>
<td>420</td>
<td>5</td>
<td>8</td>
</tr>
<tr>
<td>17</td>
<td>510</td>
<td>6</td>
<td>9</td>
</tr>
<tr>
<td>18</td>
<td>605</td>
<td>9</td>
<td>10</td>
</tr>
<tr>
<td>19</td>
<td>620</td>
<td>9</td>
<td>10</td>
</tr>
<tr>
<td>20</td>
<td>470</td>
<td>6</td>
<td>8</td>
</tr>
<tr>
<td>21</td>
<td>350</td>
<td>6</td>
<td>7</td>
</tr>
<tr>
<td>22</td>
<td>205</td>
<td>3</td>
<td>5</td>
</tr>
<tr>
<td>23</td>
<td>250</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>24</td>
<td>500</td>
<td>6</td>
<td>8</td>
</tr>
<tr>
<td>25</td>
<td>550</td>
<td>7</td>
<td>9</td>
</tr>
<tr>
<td>26</td>
<td>590</td>
<td>8</td>
<td>9</td>
</tr>
<tr>
<td>27</td>
<td>390</td>
<td>6</td>
<td>6</td>
</tr>
<tr>
<td>28</td>
<td>400</td>
<td>6</td>
<td>6</td>
</tr>
<tr>
<td>29</td>
<td>602</td>
<td>9</td>
<td>11</td>
</tr>
<tr>
<td>30</td>
<td>485</td>
<td>6</td>
<td>7</td>
</tr>
</tbody>
</table>
Using the above data, the parameters (A, α, and β) of a Cobb-Douglas production function is estimated with help of least-square regression method as follows:

1. First, transform the production function, \( Q = A K^\alpha L^\beta \) by taking the natural logarithm of each term in the function, that is,

\[
\ln Q = \ln A + \alpha \ln K + \beta \ln L
\]

By transforming the output, capital (exchange input hour), and labor (TRA input hour) data into logarithms, the least- squares regression method can be used to estimate the parameters. Using a standard multiple regression computer program, the following results were obtained:

\[
\ln Q = 3.855 + 0.5143 \ln K + 0.649 \ln L \quad \text{R}^2 = 0.96
\]

Taking antilogarithm, the function is rewritten as

\[
Q = 47.2 K^{0.5143} L^{0.649}
\]

2. Return to scale are increasing because \( \alpha + \beta = 0.5143 + 0.649 = 1.163 \) is greater than 1.

If \( K = 7 \) and \( L = 8 \) is taken as average inputs in the above production function, then

**Output, \( Q = 47.2 \times 7^{0.5143} \times 8^{0.649} = 495.09 \)**

The marginal product for \( K \) and \( L \) are

\[
\begin{align*}
\text{MP}_K &= \alpha AK^{\alpha-1}L^\beta = 0.5143(47.2) K^{-0.4857} L^{0.649} \\
&= 0.5143(47.2) 7^{-0.4857} 8^{0.649} \\
&= 36.37 \\
\text{MP}_L &= \beta AK^{\alpha} L^{\beta-1} = 0.649(47.2) K^{0.5143} L^{-0.351} \\
&= 0.649(47.2) 7^{0.5143} 8^{-0.351} \\
&= 40.16
\end{align*}
\]

These estimate mean that one-unit change in exchange input hour at telephone exchange (K) with TRA unit input hour (L) held constant at 8 would result in 36.37 unit change in output, and a one-unit change in TRA unit input hour (L) with exchange input hour (K) held constant at 7 would result in 40.16 unit change in output.

**Performance Analysis**

In the new system, more than 12000 phone lines could be disconnected in a day. The total time taken to disconnect these 12000 indicators was approximately 14 hours at telephone exchange and 1 hour at TRA unit. Therefore, under this new system only two persons were required for performing entire activities of disconnection in a single day. The disconnection activity was not required on daily basis, as the activity of disconnection for that particular billing cycle could be done on the same day of preparation of disconnection list by TRA just after payment due-date. In the process of reconnection, the speed and accuracy was enhanced in the new system as manual data feeding process for interrogation and reconnection, practiced in the old system were replaced by command files.

With \( Q = 495 \) per day ( when \( K = 7 \) and \( L = 8 \) ) in the old system of disconnection, the number of days required to disconnect 12000 indicators was 24 days and in terms of hour it was 168 hours at
telephone exchange and 192 hours at TRA unit. This meant that the system required 3 persons with 5 hours working hours per day for 24 days to carry out the disconnection activity of that particular billing cycle.

Again, if inputs were taken as $K = 14$ and $L = 1$ in the old system, then the output was 183.4 [i.e. $Q = 47.2 \times 14^{0.5143} \times 1^{0.649} \times 183.4$] whereas in the new system the output was 12000 with the same input values of $K$ and $L$.

### Performance Summary

<table>
<thead>
<tr>
<th>System</th>
<th>Output</th>
<th>Staff requirement</th>
<th>Time duration in Hours</th>
<th>Additional requirement</th>
<th>Infrastructure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Old</td>
<td>12000</td>
<td>3 No. of Staffs, 24 No. of Days</td>
<td>360</td>
<td>Nil</td>
<td>Nil</td>
</tr>
<tr>
<td>New</td>
<td>12000</td>
<td>2 No. of Staffs, 1 No. of Days</td>
<td>15</td>
<td>Nil</td>
<td>Nil</td>
</tr>
</tbody>
</table>

As performance of this new system for disconnection and reconnection activity was better than the old system in terms of accuracy and efficiency, this new system was introduced in 2004 and it continued till the day it was finally replaced by CDR based billing system in the year 2011. The CDR based billing system was product of a major business process-reengineering project, which was taken up at the topmost level decision hierarchy of the BSNL i.e. Corporate Office.

### 7. Conclusion

The objective of this study was to examine whether business process reengineering could be adopted in the bottom line of the companies where people working in such level enjoyed limited decision-making capability. This research study involved study of the core competencies of the existing resources and utilization of these resources in best possible way to a system, which could lead to the productivity of a company without additional costs and infrastructure. This study was carried out with an experiment in the existing system of a telecom company at its operations level. Based on the outcome of the study and experiment we can conclude that reengineering process can be practiced even at the bottom line level of the companies for better performance and productivity. Further, it reveals that even with low or no cost, reengineering process can be taken up at this level if competencies of the resources and technologies are fully explored. The results show that critical analysis of the existing system blend with analysis of the competencies of the technologies would help people in the operations level, in-fact within the scope of their decision level think for an innovative process that can land to a better reengineered process which will ultimately provide better performance and productivity.

### 8. References


