CHAPTER 6
RESULTS AND DISCUSSIONS

6.1 INTRODUCTION

The experience of the practical implementation reported in the previous two chapters revealed the practical validity of applying the TFMEA technique in tea industry and enhancing the quality of tea. Efforts were taken to meticulously follow the 13 distinct steps in both the tea manufacturing companies selected for conducting the implementation studies on the TFMEA technique. In the doctoral work being reported in these chapters the implementation experiences in these tea manufacturing companies have been analyzed by keeping the hypothetical case study as the benchmark. The results of this analysis are presented and discussed in this chapter.

6.2 RESULTS

The results of investigating the implementation of the TFMEA technique through its 13 steps are briefly described in the following subsections.

6.2.1 Step I: Exposing TFMEA programme to the management

During the development of hypothetical case study, it was proposed to conduct an exposure programme on the TFMEA technique to the top management. In both Pandian tea industry and Highfield tea industry this task was successfully carried out by the author of this thesis. In both Pandian tea industry and Highfield tea industry, the author of this thesis was recognized as the coordinator of the TFMEA programme. This recognition enabled the author of this thesis to coordinate the entire proceedings of the TFMEA programme. The top management of the
Pandian and Highfield tea industries were briefed on the salient features of the TFMEA technique and its potential in improving the quality of tea, and also enhancing the manufacturing productivity of the tea. Therefore according to the qualitative assessment of the coordinator, the performance of the exposure programme on the implementation of TFMEA model was complete in all aspects in both Pandian tea industry and Highfield tea industry. The quantitative assessment is that, in both Pandian tea industry and High Field tea industry, the implementation of the first step of TFMEA was 100% in comparison to that is stipulated in the hypothetical case study.

6.2.2 Step II: First joint meeting with managerial employees and laborers on TFMEA programme

According to the hypothetical case study, it is required to convene a joint meeting of a group comprising the managerial employees and laborers. In both Pandian tea industry and Highfield tea industry, this meeting was convened and the importance of manufacturing high quality of tea was emphasized and the audience of this meeting was made to understand that unless high quality tea is manufactured, it would be very difficult to face the stiff global competition. It was also emphasized that urgent actions needed to be taken to enhance the quality of tea and that TFMEA technique could be used as a tool while executing these actions. The participants were also informed that more details on the TFMEA technique would be explained to them in the next meeting. On the whole, the qualitative assessment was that, the implementation of this second step of TFMEA technique was complete in all aspects. The quantitative assessment is that, during this step, 100% of the actions stipulated in the second step of hypothetical case study on the TFMEA implementation were carried out in both Pandian tea industry and Highfield tea industry.
6.2.3 Step III: Second joint meeting with managerial employees and laborers on the conduct of TFMEA programme

According to the hypothetical case study, a second joint meeting of the managerial employees and laborers is to be convened. This joint meeting was convened in both Pandian tea industry and Highfield tea industry. In this meeting, the method of using TFMEA programme was explained in detail to the participants using simple and lucid language. The participants of the meeting were requested to begin the TFMEA programme by first listing the various defects affecting the quality of tea. The participants of the meeting were very enthusiastic and were willing to participate in the TFMEA programme. They also listed the major defects that affect the quality of tea. On the whole, the qualitative assessment is that, the implementation of this third step of TFMEA technique was complete in all aspects. The quantitative assessment is that, during this stage, 100% of the actions stipulated in the third step of hypothetical case study on the TFMEA implementation were carried out in both Pandian tea industry and Highfield tea industry.

6.2.4 Step IV: Discussion with managerial employees about laborers’ interest towards TFMEA programme

According to the hypothetical case study, the coordinator was required to discuss with the managerial employees and also convey to them the degree of interest and enthusiasm shown by the laborers towards involving and supporting the TFMEA programme. During this step, detailed and thorough discussion was held on the list of major defects affecting quality of tea identified during the second joint meeting in the third step of implementing the TFMEA technique. After this detailed discussion, the managerial employees approved the list of defects that needed to be overcome using the TFMEA programme. The qualitative assessment was that, the coordinator could implement the fourth step of TFMEA technique to the complete extent with respect to the tasks specified in the hypothetical case study to carry out the same step. According to the quantitative assessment of the coordinator, this
fourth step of TFMEA implementation could be implemented to 100% extent at both Pandian tea industry and Highfield tea industry.

**6.2.5 Step V: Invitation of laborers to become members of TFMEA team**

According to the hypothetical case study, during the fifth step of implementing TFMEA technique, it is required to approach the laborers in groups and invite them to join as TFMEA team members. Both at Pandian tea industry and Highfield tea industry, the names of those laborers who were willing to become members were noted down. At both companies the laborers were very much interested and willing to join as members of the TFMEA team. The qualitative assessment is that, this fifth step of TFMEA programme could be completely implemented in both Pandian tea industry and HighField tea industry. In the quantitative assessment, on the estimate of the coordinator, both at Pandian tea industry and Highfield tea industry it was possible to implement this step of TFMEA technique to the 100% extent.

**6.2.6 Step VI: Formation of TFMEA team**

In this step of TFMEA implementation, in consultation with the managerial employees, the TFMEA team members are to be chosen. From the list of laborers who were willing to join as TFMEA team members, the managerial employees approved the selection of five laborers to serve in the TFMEA team. In addition to the five laborers, another five managerial employees who were willing to join in the TFMEA team were also chosen. Then the TFMEA team with totally ten members was built in both Pandian tea industry and Highfield tea industry. The qualitative assessment is that, the implementation of this sixth step of TFMEA implementation in both Pandian tea industry and Highfield tea industry was complete in all respects. In the quantitative assessment, on the opinion of the coordinator, both at Pandian tea industry and Highfield tea industry, this sixth step of TFMEA model could be implemented to the extent of 100%.
6.2.7 Step VII: First meeting of TFMEA team

In the seventh step of TFMEA implementation, the first meeting of the TFMEA team was convened at both Pandian tea industry and Highfield tea industry. During this meeting, the brainstorming tool was explained to the TFMEA team members. The TFMEA team members were briefed about the rules and regulations to be followed while participating in the brainstorming session. They were also informed that brainstorming tool was to be used for developing the TFMEA tables. The qualitative assessment is that, this seventh step of TFMEA could be successfully implemented in both Pandian tea industry and Highfield tea industry to the complete extent with respect to the activities specified under the same step of the hypothetical case study. With respect to the quantitative assessment in both Pandian tea industry and Highfield tea industry, these activities could be carried out to the 100% extent.

6.2.8 Step VIII: Conduct of first brainstorming session and development of TFMEA tables

In the eighth step of TFMEA implementation, the TFMEA team members are required to identify the defects of the product or service which is under study and suggest solutions to overcome those defects. The information and knowledge thus gained from the suggestions of TFMEA team members are to be used to develop TFMEA tables. In order to carry out this task, during the doctoral work being reported in this thesis, in both Pandian tea industry and Highfield tea industry, the brainstorming tool was used to identify the primary cause of the defects found in tea and the TFMEA team members also suggested the remedies to overcome those defects.

Based on the information and knowledge gathered from the TFMEA team members, the TFMEA tables were developed. The TFMEA tables thus developed formed the basis for the prevention of defects while manufacturing tea in
both Pandian tea industry and Highfield tea industry. The qualitative assessment is that, this eighth step of implementing TFMEA technique in both Pandian tea industry and Highfield tea industry was complete with respect to the activities specified under the same step of the hypothetical case study. With regard to the quantitative assessment, in the opinion of the coordinator, the brainstorming session and the preparation of TFMEA tables were both carried out to the 100% extent in both Pandian tea industry and Highfield tea industry. During the development of the TFMEA tables, the coordinator’s assistance was availed to the significant extent. These TFMEA tables were useful to identify not only the defects in tea, but also to pinpoint the actions which on implementation will be capable of preventing the occurrence of such defects. This facility would enable the holistic improvement of the quality of tea being manufactured in both Pandian tea industry and Highfield tea industry.

6.2.9 Step IX: Approval of TFMEA tables by the top management

In the ninth step of TFMEA implementation, the TFMEA tables are to be submitted to the top management for approval. The top managements of both Pandian tea industry and Highfield tea industry were highly appreciative of the efforts taken to formulate the TFMEA tables. However these top management personnel were noncommittal in according immediate permission to implement the actions suggested by the TFMEA team for overcoming the defects in the manufacturing of tea.

The qualitative assessment is that since the management approved only the TFMEA tables and not the implementation of the remedial actions suggested in them, the implementation of this ninth step of TFMEA programme at both Pandian tea industry and Highfield tea industry was partial. Therefore, in the assessment of the coordinator, this ninth step in the TFMEA implementation process is 50%
successful in both Pandian tea industry and Highfield tea industry with respect to the activities specified under the same step of the hypothetical case study.

6.2.10 Step X: Convening a meeting of TFMEA team to convey the decision of the top management for implementing the TFMEA programme

In this tenth step of TFMEA implementation, it is required to convey the approval of the top management for implementing the actions recommended in the previous meeting. After getting the information about the approval of the top management, the TFMEA team members are required to go to their respective sections and identify the personnel for implementing the recommended actions found in the TFMEA tables. In the case of both Pandian tea industry and Highfield tea industry, this step could not be carried out since top management of both these tea manufacturing companies were noncommittal in granting permission for immediately implementing the actions specified in the TFMEA tables for rectifying the defects in the manufacturing of tea. The qualitative assessment is that, this tenth step of TFMEA could not be implemented with respect to the tasks specified under the same step of hypothetical case study. Therefore, the extent of implementing this tenth step of TFMEA technique in both Pandian tea industry and Highfield tea industry is 0%.

6.2.11 Step XI: Implementation of TFMEA programme

On getting the necessary approval of the top management, it is required to muster support of all the stakeholders of the company for successfully implementing the TFMEA programme. The next step is to review the results of the TFMEA program. If the results of the review show significant gains, then the top management may consider implementing the TFMEA program. In case the results do not show any significant gains, then the top management may not continue with the implementation until corrective measures are taken to rectify the mistakes if any in the implementation of the TFMEA programme.
In the case of both Pandian tea industry and Highfield tea industry, though the top managements were highly appreciative of the potential of the TFMEA programme, they were noncommittal in according the necessary permission for immediately implementing the TFMEA programme in their work environments. Under these circumstances, in order to move forward in the direction of assessing the practicality of the TFMEA program in the tea manufacturing companies, a questionnaire was prepared to get the responses of the top management personnel who have rich experience in the manufacturing of tea in the respective tea manufacturing companies under consideration. The Likert’s scale of range 0 – 10 was provided to the respondents for expressing their responses. Based on the responses from the respondents, the practicality of implementing the actions suggested by the TFMEA team was categorized as ‘very easy to implement’, ‘easy to implement’, ‘difficult to implement’ and ‘very difficult to implement’.

In the case of Highfield tea industry the detailed analysis of the responses of the respondents indicated that the actions suggested for overcoming failures for 80% of the failures fall under the ‘very Easy’ and ‘Easy’ to implement category, 20% of the failures come under the ‘difficult to implement’ category and none of the failures come under the ‘very difficult to implement’ category. In the case of Pandian tea industry, the detailed analysis of the responses of the respondents indicate that, the actions suggested for overcoming failures of 60% of the failures fall under the ‘very Easy’ and ‘Easy’ to implement category, 30% of the failures fall under the ‘difficult to implement’ category and 10% of the failures fall under the ‘very difficult to implement’ category. In the case of Highfield tea industry it is significant to note that none of the actions suggested fall under the ‘very difficult to implement’ category and 80% of the actions suggested fall under the ‘very easy’ and ‘easy’ category. Therefore it can be concluded that, the actions suggested by the TFMEA team to overcome failures has a minimum 80% success rate of implementing them in Highfield tea industry. Whereas in Pandian tea industry it can be derived that, there is a minimum 60% success rate of implementing the actions.
suggested by the TFMEA team for overcoming failures. As the actions suggested by developing TFMEA tables in both Pandian tea industry and Highfield tea industry have a minimum of 60% and above success rate, it is clearly evident that the TFMEA program is practically implementable in tea industry for overcoming failures and improving the quality of tea.

As the management personnel were noncommittal in granting permission to immediately implement the TFMEA program in both Pandian tea industry and Highfield tea industry, only human judgment was applied to assess the practicality of implementing the actions suggested through the conduct of the TFMEA program. However, this was overcome to a certain extent by getting the feedback from the experienced managerial personnel who have rich experience in the tea industry. As only human judgment was used to assess the practicality of implementing the solutions evolved by the TFMEA team for overcoming the failures of the tea industry, the qualitative assessment is that, the implementation of this eleventh step of the TFMEA programme is partial in both Pandian tea industry and Highfield tea industry. In the opinion of the coordinator, this eleventh step of TFMEA programme could be implemented to an extent of 40% with respect to the tasks specified under the same step of hypothetical case study.

6.2.12 Step XII: Review of implementation of the TFMEA programme

According to the hypothetical case study, during the twelfth step, it is required to review the implementation of the actions recommended through the development of TFMEA tables and assess the quality of tea by reviewing the price fetched by it in the market. Based on the inputs received from the feedback furnished by the various respondents in the previous step, an analysis was also carried out to find out the financial benefits that could be derived by implementing the TFMEA program in both Pandian tea industry and Highfield tea industry. The results of this analysis have indicated that by implementing the TFMEA programme, Pandian tea Industry would be able to increase its revenue by 5%
annually. In the case of Highfield tea industry, the implementation of the TFMEA program would result in an increase of revenue by 4.3% annually. The increase in revenue is due to the absence of defects and anticipated improvement in the quality of tea manufactured after implementing the TFMEA programme. However, these values are only the projections and not the actual. Hence the qualitative assessment is that, this twelfth step of TFMEA program was partial in both Pandian tea industry and Highfield tea industry with respect to the activities specified under the same step of hypothetical case study. According to the opinion of the coordinator, the extent of implementing the twelfth step of TFMEA programme is 30%.

6.2.13 Step XIII: Informing the results of the implementation of the TFMEA programme to the top management

In the last and thirteenth step of implementing the TFMEA programme, the coordinator had a meeting with the top management of both Pandian tea industry and Highfield tea industry. During this meeting, the coordinator informed the top managements about the results of the analysis and emphasized that the TFMEA programme was practically implementable in the tea industry. The coordinator also appraised the top management that, by implementing the TFMEA programme, the tea manufacturing companies can increase their annual revenue by a minimum of 4%. Since the top management was noncommittal in immediately implementing the TFMEA programme for overcoming all the failures encountered in manufacturing tea at both Pandian tea industry and High Field tea industry, it was emphasized to them that they can start implementing the ‘very easy actions’ first and then proceed to implement the ‘easy’, ‘difficult’ and then the ‘very difficult actions’. In the case of Pandian tea industry, it was estimated that by implementing the TFMEA program for overcoming just one failure which falls under the ‘very easy category’, the management will be able to bring down the revenue loss by 31% of the total loss in revenue. In the case of Highfield tea industry, it was estimated that by implementing the TFMEA program for overcoming just one failure which falls under the ‘very easy category’, the management would be able to bring down
the revenue loss by 8% of the total revenue loss. Based on the analysis and, the positive results and benefits achievable, the managements of both Pandian tea industry and Highfield tea industry could be persuaded to grant approval for fully implementing the TFMEA programme. As these values are only the projections and not the actuals, the qualitative assessment is that, the last and thirteenth step of TFMEA implementation is only partial in both Pandian tea industry and Highfield tea industry. In the opinion of the coordinator, the qualitative assessment is that, the extent of implementing the last and thirteenth step of TFMEA programme is 40% at both Pandian tea industry and Highfield tea industry.

As mentioned in the above subsections, most of the steps of TFMEA implementation could be carried out to the 100% extent in both Pandian tea industry and Highfield tea industry. However, in the case of implementing a few critical steps of TFMEA model, the implementation could be carried out only to a partial extent. This deficient part of TFMEA implementation is subjected to discussions in the next section.

6.3 DISCUSSIONS

The implementation of TFMEA technique at Pandian tea industry and Highfield tea industry is discussed in this section by drawing the experiences described in the previous section. In order to aid this discussion, the qualitative and quantitative assessments of the TFMEA implementation at Pandian tea industry and Highfield tea industry with respect to the hypothetical case study are summarized in Table 6.1.

After presenting the information, the steps in which the implementation of TFMEA is incomplete in both Pandian tea industry and Highfield tea industry are indicated using asterisk mark (*). As shown, out of 13 steps, the asterisk mark is seen in the case of five steps. Further, the extent of implementation which is less
Table 6.1 Extent of implementation of TFMEA programme at Pandian tea industry and Highfield tea industry with respect to the steps specified in hypothetical case study

<table>
<thead>
<tr>
<th>Step number</th>
<th>Title of the step of TFMEA implementation</th>
<th>Extent of implementation with reference to the hypothetical case study</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Quantitative assessment</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Pandian tea industry</td>
</tr>
<tr>
<td>1</td>
<td>Exposing TFMEA to the management</td>
<td>100%</td>
</tr>
<tr>
<td>2</td>
<td>First joint meeting with managerial employees and laborers on TFMEA</td>
<td>100%</td>
</tr>
<tr>
<td>3</td>
<td>Second joint meeting with managerial employees and laborers on the conduct of TFMEA program</td>
<td>100%</td>
</tr>
<tr>
<td>4</td>
<td>Discussion with managerial employees about laborer’s interest towards TFMEA</td>
<td>100%</td>
</tr>
<tr>
<td>5</td>
<td>Invitation of laborers to become members of TFMEA team</td>
<td>100%</td>
</tr>
<tr>
<td>6</td>
<td>Formation of TFMEA team</td>
<td>100%</td>
</tr>
</tbody>
</table>
Table 6.1. (continued)

<table>
<thead>
<tr>
<th></th>
<th>First meeting of TFMEA team</th>
<th>100%</th>
<th>100%</th>
<th>Complete</th>
<th>Complete</th>
</tr>
</thead>
<tbody>
<tr>
<td>8</td>
<td>Conduct of first brainstorming session and development of TFMEA tables</td>
<td>100%</td>
<td>100%</td>
<td>Complete</td>
<td>Complete</td>
</tr>
<tr>
<td>9*</td>
<td>Approval of TFMEA tables by the top management</td>
<td>50%</td>
<td>50%</td>
<td>Partial</td>
<td>Partial</td>
</tr>
<tr>
<td>10*</td>
<td>Convening a meeting of TFMEA team to convey approval by the top management for implementing the TFMEA program</td>
<td>0%</td>
<td>0%</td>
<td>Not implemented</td>
<td>Not implemented</td>
</tr>
<tr>
<td>11*</td>
<td>Implementation of TFMEA program</td>
<td>40%</td>
<td>40%</td>
<td>Partial</td>
<td>Partial</td>
</tr>
<tr>
<td>12*</td>
<td>Review of implementation of the TFMEA program</td>
<td>30%</td>
<td>30%</td>
<td>Partial</td>
<td>Partial</td>
</tr>
<tr>
<td>13*</td>
<td>Informing the results of the implementation of the TFMEA program to the top management.</td>
<td>40%</td>
<td>40%</td>
<td>Partial</td>
<td>Partial</td>
</tr>
</tbody>
</table>

than 100% is earmarked using square symbol. The reasons for lower degree of implementation of the five steps of TFMEA technique with respect to the hypothetical case study are discussed in this section.

During the ninth step of TFMEA implementation, it is required to submit the TFMEA tables to the top management and get their approval for implementing
the actions suggested by the TFMEA team to overcome the failures encountered in
the manufacturing of tea. It is also required to get approval to start the
implementation of the TFMEA programme in the respective tea industry. This
ninth step could not be carried out to the complete extent as the top management
approved the TFMEA tables but was noncommittal in granting approval for
immediately implementing the TFMEA programme in their tea manufacturing
companies. This is one of the major hurdles in the implementation of the TFMEA
technique encountered during the conduct of the doctoral work being reported here
in both the tea manufacturing companies. The top managements were hesitant to
grant approval since they were not very certain about the benefits that they would
be able to reap due to the implementation of the TFMEA technique. This hurdle was
overcome by supplying a questionnaire on the practicality of TFMEA technique
and eliciting the responses through them from the managerial employees who have
vast experience in the field of tea manufacture.

During the implementation of, the tenth step of TFMEA programme, it is
required to convey the TFMEA team members about the granting of approval by the
top management towards the implementation of the actions evolved by developing
TFMEA tables. Since the top managements of both Pandian tea industry and
Highfield tea industry did not approve the implementation of the actions evolved by
developing TFMEA tables, this tenth step of TFMEA programme could not be
implemented in the doctoral programme being reported here.

During the eleventh step, it was required to actually implement the
TFMEA programme in both Pandian tea industry and Highfield tea industry.
However, this action was not possible because top management approval could not
be obtained for immediately implementing TFMEA technique. However, this hurdle
was overcome by preparing a list of questions related to the failures affecting the
quality of tea and the possible remedial actions suggested by the TFMEA team to
overcome these failures. The questionnaire was given to selected managerial
personnel possessing rich experience in the field of tea manufacture and their responses were gathered. The data obtained from the responses of these personnel was analyzed to get a clear picture on the practicality of implementing the TFMEA programme in the tea industry and also the benefits achievable through its implementation. The major limitation encountered during the execution of this step is that, only human judgment could be used to assess the practicality of implementing the solutions of the TFMEA team for overcoming the failures of the tea industry. However, in future this limitation can be overcome by informing and educating top management about the results of the analysis and benefits achievable through the implementation of the TFMEA program. This will enhance the confidence of the top management personnel and will also motivate them to grant permission for implementing the TFMEA program in real time situations.

During the twelfth step, the results of the implementation of TFMEA programme are required to be reviewed. This exercise could not be carried out as the actions evolved through the development of the TFMEA tables could not be actually implemented in both Pandian tea industry and Highfield tea industry. In order to compensate this limitation of this doctoral work, the financial benefits achievable through the anticipated implementation of the TFMEA programme were projected. The top managements of both Pandian tea industry and Highfield tea industry nourished these projections but they wanted more time to consider the possibility of granting permission to implement the TFMEA program in their companies.

In the last and thirteenth step of implementing the TFMEA programme, it is required to have a meeting with the top management of both Pandian tea industry and Highfield tea industry to inform the results of the implementation of TFMEA program in the tea companies. During this meeting, the coordinator informed the top managements about the results of the analysis and emphasized that the TFMEA programme was practically implementable in the tea industry. Since
the top management of both Pandian and Highfield tea industries were non committal in granting approval for implementation it was possible to inform the results based on only the projections and not the actual. However, to overcome this deficiency a road map has been suggested to the top managements of both Pandian and Highfield tea industries to start implementing the TFMEA programme starting with the very easy actions and proceed to the very difficult actions.

On the whole, the experiences of implementing TFMEA technique at both Pandian tea industry and Highfield tea industry indicated that, it is a practically compatible technique for application in the tea industry. This claim is made because, out of the 13 steps, eight steps of TFMEA technique could be implemented to the 100% extent with reference to the hypothetical case study. In line to this comparison, it is found that, in case of qualitative analysis, the implementation of TFMEA is ‘complete’ for all entities except for five entities for which the implementation is not possible to the complete extent. Thus qualitative analysis also indicated that the TFMEA model is a practically compatible model for enhancing the quality of tea and improving the productivity of the tea industry.

6.4 CONCLUSION

In this chapter, the results of implementing TFMEA model at both Pandian tea industry and Highfield tea industry have been summarized by making use of quantitative and qualitative assessments. The information required in this regard has been drawn from the previous two chapters, wherein the implementations of TFMEA model at both Pandian tea industry and Highfield tea industry has been explained. These results have been subjected to discussions in this chapter. These discussions indicate that, the TFMEA is a practically compatible technique which will enable the tea industries to improve the quality of tea and also increase the productivity of the tea manufacture. However, in order to successfully implement TFMEA technique, the tea industry should be willing to adopt it with interest and commitment, and also educate and train their employees for nourishing the tangible and intangible benefits of its application.