CHAPTER 5

EOE BUSINESS DYNAMICS MODEL

5.1 INTRODUCTION

This study aims in developing the Business Dynamics model to depict the impact of EOE Training on individual performance as well as organisational performance. The technique of system dynamics, which is also known as business dynamics, by terminology and usage in management research. Using Business Dynamics, EOE Model was designed, developed, validated and tested, using the tool, VENSIM software (PLE version).

5.2 BUSINESS DYNAMICS EOE MODEL DESIGN

The mental model uses the causal loops, stock and flow diagrams in the business dynamics model. The Hiring rate, Quit rate, Skill rate, Skill growth rate, EOE skill inventory rate, Performance rate etc were defined and used with the EOE metrics governing the model (Refer Appendix 3). VENSIM software package was used to simulate and validate the model, using the sensitivity analysis. The case study method was used to experiment a Pre/Post EOE Training intervention with employees in an ITES organisation in India. Using a validated EOE questionnaire, data was captured from employees in an ITES organisation in Chennai, for the validation of the business dynamics model. Future researchers can extend this work and apply it in other industries and geographies also. Any organisation can customize and utilize the business dynamics EOE model as per its requirements.
5.3 FRAMEWORK OF EOE MODEL IN MANAGEMENT

The EO inventory developed by Rao (1985) is derived for developing the EOE questionnaire. The data was captured from the employees in the ITES organisation, Chennai, India through the EOE questionnaire, which is a validated instrument. The reliability coefficient Cronbach’s alpha, for the questionnaire was 0.95.

The EOE metrics comprised of the ten factors which were used in the EOE questionnaire and comprised the EOE Training modules, namely: 1 Achievement Motivation, 2 Affiliation Need, 3 Commitment, 4 Creativity, 5 Decision Making, 6 Locus of Control, 7 Risk-Taking Propensity, 8 Tolerance for Ambiguity, 9 Training and Development and 10 Learning and Development.

Krishnakumar and Rao (2011) have identified that, there is a significant difference between employees Learning and Development pre scores and the employees’ overall EOE pre scores. Thus, Learning and Development being a very significant factor for further EOE training to be imparted to the employees. Hence the need for a session meant in the EOE training module for Learning and Development.

The objective of the research study is to propose the framework for the system’s approach to management for the EOE business dynamics model as in Figure 5.1. The input-process-output is characterised by feed forward loop/feedback loop. The EOE pre scores are fed in the input (EOE untrained employees) and the EOE post scores are the scores after the EOE training is imparted for the employees, using the EOE metrics. The retraining process is identifiable by the feedback loop.
Figure 5.1  Framework for the systems approach to Management for EOE business dynamics Model

5.4  VENSIM PLE SIMULATION SOFTWARE

The input modeling of the variables used in the Business Dynamics model are represented in Figure 5.2.
The simulation software Vensim is used for developing the business dynamics model. This software allows conceptualising, document, simulating, analysing and optimising models of dynamic systems. Vensim PLE (for Personal Learning Edition) is designed to make it easier to learn business dynamics. The business dynamics model used in this study was designed as outlined by Prasanna Devi and Rao (2010). They are of the view that the business dynamics model is designed by connecting words with arrows, indicating the relationships among the system variables. This information is used by the Equation Editor to form a complete simulation model. The model can be analysed throughout the building process, looking at the causes and uses of a variable, and the feedback loops involving the variable. When the model that can be simulated has been developed, Vensim thoroughly explores its behavior.

5.5 VALIDATION AND TESTING

A normal simulation model runs through the complete time span based on the initial setup of the model, since, a wide range of tests helps us understand and improve the model. In order to ensure the robustness of the model, we have included tests such as the direct inspection of equations, simulations of the whole model and behavior under extreme conditions. The model has been checked for errors in equations and the units are verified. The framework in systems approach to management, Refer Figure 5.1, presents in a simple manner, using which any model can be developed in management research. The facilitation of validating any business model, in any changing business environment, using this approach, can be simplified. All the aspects are taken into account, including the recent recessionary environment and its aftermths, for the development of the EOE Business Dynamics Model.
Figure 5.3 Causal Tree for the business dynamics EOE model

The Figure 5.3 presents the causal tree for the components of an EOE training programme which is considered as the mental model for developing a base EOE Business Dynamics Model. A causal loop diagram, depicting the conceptual framework, using business dynamics for the EOE Training Model, wherein the ten modules are utilized for imparting the EOE Training to the employees in an organisation.

Sterman (2000) had stated that, a causal loop diagram is a visual representation of the feedback loops in a system. Overall, SDS describes system behaviour as a number of interacting feedback loops in a causal loop diagram, as illustrated in Figure 5.4.

There are two types of feedback loops. A reinforcing loop is one in which an action produces a result which influences more of the same action thus resulting in growth or decline. The reinforcing loop is one of the two foundational structures of systems thinking, the other being the balancing Loop. A balancing loop attempts to move some current state (the way things are) to a desired state (goal or objective) though some action (whatever is
done to reach the goal). The desired state interacts with the current state to produce a gap. The desired state is considered to be fixed during this consideration. The gap created by the difference between the desired state and the current state is really the motivation for action, and the larger the gap the greater the tendency to produce action. The action taken then adds to the current state. The current state subtracts from the gap, thus reducing it. When the action succeeds in moving the current state to a point where it is equal to the desired state the gap is reduced to zero and there is no more motivation for action. The positive reinforcement (labeled R) is the behaviour of growth where it tends to reinforce or amplify the behaviour of a system. For example, the more people adopt a new product, the stronger the impact of word-of-mouth. The negative reinforcement or balancing (labeled B) is the behaviour which neutralises and opposes change. For example, the more people adopt the new product, the fewer remain as potential adopters.

The design of the causal loop diagram is one of the basic process of system dynamic modeling. The three basic symbols in stock and flow diagrams are: Stock, defined as a quantity that accumulates over time in the form of material (i.e. people) or information (i.e. knowledge) resources. Flow, which changes the values of stocks; and Auxiliary, which arises when the formulation of a stock’s influence on a flow involves one or more intermediate calculations. In the Figure 5.3 given below, there are five Reinfocing loops viz.$R_1,R_2,R_3,R_4$ and $R_5$ and Four Balancing loops viz. $B_1$, $B_2$, $B_3$ and $B_4$. 
Figure 5.4  Business dynamics model in entrepreneurial orientation for employees

Loop R₁ indicates that there will be an impact of fresh employees and the hiring rate. In contrast, loop R₂ stresses the fact that fresh employees will have an effect on EOE Training rate. Loop R₃ exemplifies the typical
fresh employees with the quit rate of fresh employees and its impact before EOE Training. As presented in loop $R_4$, hiring rate on the total employees reinforces the fresh employees who join the organisation. Loops $R_5$ emphasize, the need for fresh employees to be trained for EOE and the contributions it reinforces to the training rate of EOE trained employees, which is essential to identify the employee hiring rate.

In contrast, the balancing loop $B_1$ which comprises of EOE Trained Employees, Total Employees, Hiring Rate and Fresh Employees, EOE Training Rate means that the employment attractiveness of the industry would induce people to work in the area and so supply manpower demands. As mentioned above, however, the actual supply would depend on the discrepancy between supply and demand. In addition, loop $B_2$ suggests that undue discrepancy between supply and demand would even reduce the driving force of the industry. In the similar vein, loop $B_3$ indicates that manpower in the industry would contribute to enhancing technical expertise, technological agglomeration and technology development, all of which would rather increase employment per project, not to mention labour forces. Nonetheless, employment uneasiness derived from increased employee’s quit rate would exercise negative impact on the volume of manpower, ie fresh employee. Lastly, as labour force with special technical expertise joins the market, which necessitate for the EOE trained employees to balance the competition towards strengthening the work force in the market over time. Confronted with these circumstances, as in $B_4$ Shortfall in performance will augment with the additional EOE training rate and the financial burden on organisation as this will be a contribution to EOE Skill Inventory.
Figure 5.5 Measuring Organisational performance by varying the training time keeping the retraining time fixed = 4 weeks

From the Figure 5.5, it is inferred for a fixed retraining length of 4 weeks, it is better to opt for a training length of 5 weeks, wherein the OPI reaches a score of 10 and remains there till the end of 46 weeks. Similarly, if the retraining time as decided by the management varies (eg. If the retraining time is changed to 8 weeks), the length of training has to be varied accordingly as shown in Figure 5.6 and Table A5.1 respectively. It is also inferred that for a fixed retraining length of 8 weeks, it is better to opt for a training length of 6 weeks, wherein the OPI reaches a score of 10 and remains therein till the end of 48 weeks.
Figure 5.6  Graph showing Organisational performance by varying the training time keeping the retraining time fixed = 8 weeks

If the retraining length is changed to 12 weeks, the length of training has to be varied accordingly as shown in Figure 5.7 and Table A5.3 respectively.
Figure 5.7  Graph showing OPI by varying the training time keeping the retraining time fixed = 12 weeks

It is also inferred that for a fixed retraining length of 12 weeks, it is better to opt for a training length of 6 weeks, wherein the OPI reaches a score of “10” at time in the 16th week and remains there till the end of 48 weeks.
The EOEI was measured varying the training time, keeping the retraining time fixed = 8 weeks. The EOE skill inventory score obtained Table A5.3 is converted into corresponding EOEI Table A5.4. The time at which the average EOEI reaches 10 (satisfactory performance) and the time at which it drops below 10 (unsatisfactory performance) are measured as shown in Figure 5.6 and the detailed tabulation is given in caluclations below. It is inferred that the EOEI reaches “10” at the time frame of the 11\textsuperscript{th} week and remains at “10” till the end of 52 weeks.

EOE Skill Inventory = INTEG (Skill Building Rate +Additional Training Rate-Skill Decay Rate, 20)

Skill Building Rate = INTEG (EOE Training Rate*EOE TRAINING SCORE, 5)

Additional Training Rate = INTEG (Shortfall in Performance/Time for Addl Training, 3)

Skill Decay Rate = INTEG (EOE Skill Inventory*Time Sensitive Decay Fraction/Time for Decay, 1)

At time t= 0,

Initial EOE Skill Inventory = 20, Initial EOE skill building rate = 5,
Initial additional training rate = 3, Initial skill decay rate = 1

At time t=0, EOE, Skill inventory = 20
t=2, EOE building rate = 5 + (training rate* EOE training score)
= 5+ ((4/12)*50) = 5+16.66= 21.666

Ideal EOE score = 385, Expected EOE score = 375
Difference in EOE score = (Ideal – Expected EOE score) = 385-375= 10
At time t=2,

Addl EOE training rate = 3 + (5*12/6) = 13

EOE score = 370, Time sensitive decay fraction = 0.001, Decay time = 8 weeks
At time t= 2,
Skill decay rate = 1 + (375 * 0.001*12/8) = 1.5625

Therefore, at t = 2, EOE skill inventory = (skill building rate) +
(additional training rate) – (skill decay rate)

i.e.. EOE skill inventory = 21.66 + 13 – 1.5625, which is approximately 34.
EOE Index = EOE Skill lookup (EOE skill inventory)

EOE skill lookup([(0,0)-(50000,50000)],(1000,1),(5000,2),(10000,3),
(15000,4), (20000,5), (25000,6), (30000,7), (35000,8), (40000,9), (45000,10))
Since the EOE skill inv is 34 (obtained using manual calculation), the EOE index is 1.

Organisation Performance Lookup ([0,0)-(50000,50000)],
(1000,1), (5000,2), (15000,3), (20000,4), (25000,5), (30000,6), (35000,7),
(40000,8), (45000,9), (50000,10))

Since, this is calculated based on EOEI, the corresponding OPI is obtained as 1, for t=2.
Figure 5.8  Graph showing EOEI by varying the training time keeping the retraining time fixed = 8 weeks

Similarly, the EOEI was measured varying the training time, keeping the retraining time fixed = 12 weeks. The time at which the average EOEI reaches 10 (satisfactory performance) and the time at which it drops below 10 (unsatisfactory performance) are measured as shown in Figure 5.8 and the detailed tabulation is given in Table A5.5. It is inferred that the EOEI reaches “10” at time frame of 12th week and remains at “10” till the end of 52 weeks.
Figure 5.9  Graph showing EOEI by varying the training time keeping retraining time fixed = 12 weeks

With the increase in training time, the total number of employees who are EOE trained/year reduces. With the initial number of EOE employees set at 62, it is seen that only 159 employees are EOE trained at the end of 52 weeks, when the training time = 20 weeks, whereas, the total number of employees who are EOE trained are 303 (starting from 62 employees), when the training time is considered as 4 weeks as shown in Figures 5.9 and 5.10. Thus, if the management fixes up a budget to train “n”
number of people per year, then the corresponding training time can be
determined, given the initial number of employees who are put in the first
batch of training, as understood from Table A5.6.

![Graph showing the impact of training time on the number of EOE trained employees](image)

**Figure 5.10** Graph showing the impact of training time on the number of EOE trained employees

With the increase in training time, the number of employees who quit the organisation reduces from 23 (for 4 weeks trained employees) to 12 (for employees who are trained for 20 weeks). This difference is not significant for investing a huge amount on training. This is illustrated in Figure 5.10 and the detailed results are given in Table A5.7. Table A5.9 represents the EOELI scores, and the corresponding OPI is obtained as 1 for \( t=2 \).
Figure 5.11 Graph showing the impact of varying training time on the number of employees who quit the organisation

5.6 ILLUSTRATION OF DECISION MAKING

If the management allocates a budget to accommodate training for 5 weeks, the organisational performance can be measured and the retraining time can be adjusted as follows:

From Table A5.2, choosing a training time = 5 weeks and retraining time = 8 weeks, the organisational performance meets the expectation (threshold >= 10), from the time period = 16 to 48 weeks, after which it drops below 10. The OPI drops to 7.9 and 5.2 in the subsequent two weeks respectively. Choosing a training time = 5 weeks and retraining time = 12 weeks. From Table A5.3, the OPI remains at 10 from the time period of 16 to 48 weeks, and drops to 9.05 and 6.75 in the subsequent two weeks respectively.
Also, further it can be inferred that the EOEI of employees remains at 10 from the 12th to the 50th week for a training time = 5 weeks and retraining time = 8 weeks, after which it drops below 10. Similarly, the EOEI of employees remains at 10 from the 12th to the 52nd week, for a training = 5 weeks and retraining time = 12 weeks, from Table A5.5. Thus, it is clear that the increase in retraining time (from 8 to 12 weeks) has a considerable effect on the EOEI of the employees. The critical question of when to start the retraining process for the employees can be answered as, from the time when the EOEI drops below 10; i.e. training = 5 weeks and retraining time = 8 weeks, the retraining can be started at the end of week 50, when the EOEI drops below 10. Thus, this EOE Business Dynamics model will serve as a basic and robust simulation model for planning the employee’s training in the future. The proposed EOE business dynamics model can be fine-tuned to any organisational/industrial requirements based on the organisational development plans and objectives.

5.7 PRACTICAL IMPLICATIONS

The model facilitates the measurement of both the individual employee performance as well as organisational performance. The EOE business dynamics model contributes to the development of two indices, namely, EOEI and OPI. The policy planners, human resource strategists, and management consultants can utilise the business dynamics EOE model for effective decision making, for budgetary allocations towards training initiatives and so on. The model is novel, and the first of its kind using business dynamics in entrepreneurial orientation for employees. The Human resource planners can use this model for forecasting the man power needs as well as skill development, employee empowerment and organisational development.
5.8 SUMMARY

The Business Dynamics EOE Model serves as a decision tool to determine the time of training and the retraining time required for achieving a desired OPI. The training activities can be well planned using this Model. Decision makers are facilitated to track the employee’s performance by the measuring the EOE Index. The retraining process can be commenced to achieve the best throughput from the employees in the organisation by deciding on the EOE Index falling below the specified threshold. The Business Dynamics Model in EOE helps the decision makers in the management to look at various options and decision criteria can be identified in the future by customising the objective and goals of the organisation. Thus, a new dimension for evaluating the employees’ performance as well as the organisational performance, using the EOEI and OPI indices which are newly developed and proposed through this research work.

The augmentation of the work force, man power planning problems like labour turnover, attrition rate, career management concerns, organisational growth initiatives etc., can be given due importance for future research. The systematic training and retraining pattern are derived using the EOE business dynamics model, which will definitely serve as a bench mark for the future. There may be new dimensions or other approaches which may emerge in future, but this EOE business dynamics model shall definitely serve as a solid base for constructing any sort of building for that matter. Hence, the Business Dynamics Model shall defiantly stand the test of its time. Finally, the last Chapter 6, offer certain conclusion and suggestions to various stakeholders. The scope for further research wherein exact time of hand holding of the training process can be estimated and thereby the ROI be calculated.