CHAPTER 5

ABC SCHEDULING FOR MULTI-PERIOD DTO OF EOL PRODUCTS

The previous chapter (Chapter 4) deals with an adaptive genetic algorithm based approach for the end of life product disassembly. The previous chapter only concentrates on cost reduction, so it fails in time constrain. Hence in this chapter, time is consider as one of the major objective while selecting the optimal number of E-O-L products. Here, the time taken for the disassembly of E-O-L products is reduced by the novel scheduling algorithm. The artificial bee colony algorithm is employed in this chapter for the optimal scheduling and product selection of disassembly. The proposed strategy can effectively reduce the cost and time spend for the E-O-L reverse logistics.

An inventive reverse logistics (RL) work goes far in engaging elements with the ability to better use of eco-vitality and assets and achievement of a calm exchange off between money related framework and eco-range (D. S. Rogers and R.S. Tibben-Lembke, 2011). Online buys, mail, arranges and after deals have contributed their vermin in the shocking rate of profits in the associations, which have extremely neglected to concentrate on zooming rewards. In the perspective of the varieties in reliable measures, planned both for eco-kind disposition and administration interests. The lion's share of association is seen falling back on the course of reverse streams which constitute going in the regressive heading from customers to recuperation center points situated inside their logistics organized (F. Ciliberti, et al. 2008).

Reprocessing of customer products remains no longer an advancement. The reprocess of expanded materials carries with its different components, for example, accumulation, association and preparing, and the triumph calculated by the attitudes achieved by the method for well-suited synchronization and digestion. It has Eco measurements alongside measurements as far as esteem recovery (Q. Zhu et al. 2008; A. Mutha, and S. Pokharel, 2009).

Obsolete items are likewise regularly marked as end-of-life (EOL) items. There is a procedure to direct these things, for example, reprocess, reuse or transfer. Transfer, thus, creates additional reductions in the quantity of landfills predicting a grave danger to the environment unless it is dealt with prudently. All concerned comprehensive of the Government, makers and end-clients are viable illuminated of the inherent hazards, preparing for the surrounding of different eco-accommodating principles and controls (A. Gungor and S. M. Gupta, 1999; C. Prahinski and C. Kocabasoglu, 2006).

The rhythm of the item returned by the end customers is alarmingly high for magazines, scanners, PCs, cameras, mobile phones, books, clothes, and car, electronic, airship segments, substance and medicinal things. The oppressed customers tend to produce a clarion call for replacement or exchange of items considered insufficient in quality. The scope of item returns goes out of this world, including certain ventures to the tune of the greater part of the deal value. Since the most recent decade-long lasting return controls have been doing the rounds in the created nations, constraining the business magnates to proficiently oversee the entire existence of the item (D. S. Rogers and R.S. Tibben-Lembke, 2011).

Returned items are accumulated, investigated and ordered based on their working properties. Also, the representative controls, when the arrival is acknowledged, and additionally measures taken. In any case, the principle nervousness is the reality, whether the recovery of items is more financially savvy than the dumping of the items. A noteworthy lump of the supply chain administration concentrates on the forward movement, and the remodel of the materials from the providers downstream to the end customers and the influence the change employs on the bullwhip impact. By and by, the reverse stream of items from the customers on upstream business has not revealed any noteworthy energy (E. Grenchus et al. 1997).

Dismantling is the underlying strategy to recapture parts and materials from EOL items for re-utilization and reprocess. As the reclaim items come back to the organization in shifted of conditions, it was difficult to have an earlier information about precisely what number of elements required for dismantling to take care of the demand for segments and materials. No big surprise, this vagueness winds up further confounding the dismantling system (V.D.R. Guide et al. 1997; Bloemhof-Ruwaard et al. 1995).

One of the massive strategies to direct the resultant threat is to fall back on the work of heuristic procedure to change the stochastic brand into a deterministic mode and after that set out to comprehend the deterministic hazard (L. Moyer and S. M. Gupta, 1997). In result, the major point here is to improve the quantity of the reclaimed item to dismantle to upgrade the benefit of offering segments and materials, without in any capacity making harm the eco-framework. In the proposed work, the time taken for RL is reduced by utilizing an ideal scheduling algorithm.

A portion of the current research business related to the E-O-L reverse logistics recorded underneath.

More past articles on dismantling booking are crippled ones, i.e., as far as possible objectives not consider. In (S.M. Gupta and K.N. Taleb, 1994) find the major case, without parts, shared trademark, and prescribe an accurate count without the clear target. In (D.H. Lee and P. Xirouchakis, 2004) proposed heuristic estimation for the objective of limiting the costs related to destroying the system. For the extended models along with parts shared trademark as well as different thing sorts, see ((H.J. Kim et al. 2003) - (K.N. Taleb et al. 1997)).

Starting late (D.H. Lee et al. 2004) showed the linear programming models for all the incapacitated cases together with their presentations. In (D.H. Lee et al. 2002) consider as far as possible necessities unequivocally as well as proposed a linear programming model with various cost segments occurred in destroying methods. Regardless of the way that the design can give perfect game plans. Honestly, the computational outcomes show that it is not adequate for relevant assessed issues due to its nonsensical handling times.

In (R.B. Payne et al. 2005) authors subjectively imagined a logical model that bridges the general dealing with expenses of different classes of waste electrical and electronic products (WEEPs). Then (J. Arora, 1989) have charmingly passed on to spotlight an original chat logistics flexibility structure, which separated into down to earth operational and imperative adaptabilities. In (Chattopadhyay R., 1971) have brilliantly pushed an innovative strategy to delineate appropriate presumptions in energy about a particular condition of end-of-life association in Iran to modify the issue as a pariah inverse logistics framework.

In (K. Deb, 1995) have productively offered an innovative mixed entire number straight programming methodology which is standard for the design and organizing of supply chains with inverse streams despite a concurrent appraisal of the era, scattering and talk logistics limits. In (Melissa FW and De Ron AJ 1999) have charmingly offered exhaustive splendid data on the evaluation of current return works out. They have arranged the test suggestions for the drivers, volumes and estimation of many returns for the term of the life cycle showing the deficiency in today's return takes a shot at realizing quality rot rather than the propelled worth improvement and evaluate and unpredictability return sharpens in various areas and business endeavors. They similarly furnished tributes for changing quality decay into worth extension.

5.1 Artificial Bee Colony Algorithm

Artificial Bee Colony (ABC) algorithm is a nearly new method proposed by Karaboga (D. Karaboga, 2005). ABC empowered by the searching conduct of bumble bee swarms. The ABC algorithm state comprises of three sorts of honey bees in particular:

- Employee Bee
- Onlooker Bee
- Scout Bee

Among these three types of honey bees, the representative honey bee and the passerby honey bee are the employed honey bees, though, the scout honey bee is an unemployed honey bee. The quantities of worker honey bees and passerby honey bees are said to be equivalent to ABC algorithm. The sustenance sources considered as the likely answers for a given issue and the nectar measure of the nourishing source is the relative wellness of that specific arrangement.

The number of inhabitants in the state is double the extent of the nourishment sources. The quantity of food source speaks to the position of the conceivable arrangements on the advancement issue, and the nectar measure of a sustenance source speaks to the wellness of the related method. The pseudo code of the ABC algorithm given underneath and the streaming chart for the ABC algorithms m appeared in Fig 5.1.

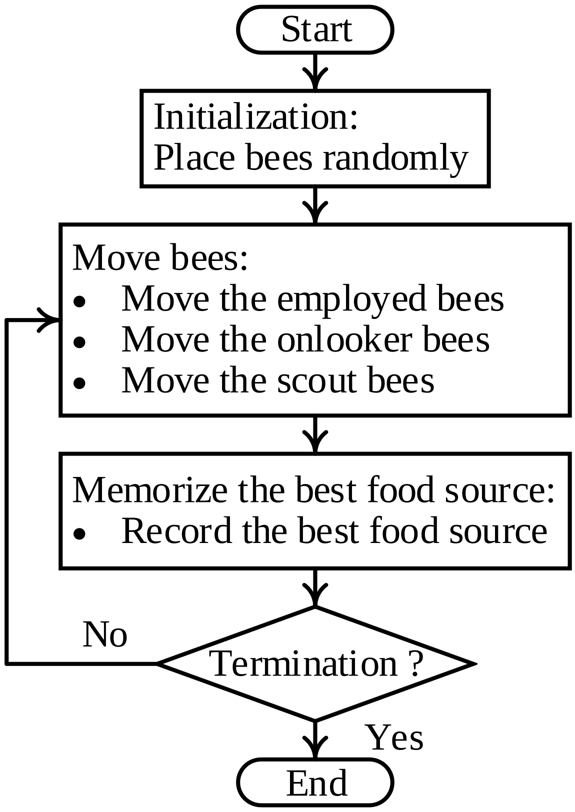

Figure 5.1. Block diagram of ABC algorithm

In the underlying stride of ABC algorithm, an arrangement of nourishment sources is chosen haphazardly by the employed honey bee, and their comparing nectar sums (i.e. Wellness esteem) are registered. The worker honey bee shares these points of interest to another arrangement of employed honey bees called as passerby honey bees. In the wake of sharing this data, the worker honey bee visits a similar sustenance source again and afterwards, finds another nourishment source adjacent utilizing the eqn. (5.1).

$$v_{i,j} = x_{i,j} + \Phi_{i,j}(x_{i,j} - x_{k,j}) \tag{5.1}$$

Where, x is the solution set, k and j are the randomly selected index that represents the particular solution from the population. Φ is a random number between [-1,1]. At the point when new neighboring sustenance sources are created, their wellness qualities are ascertained and the worker honey bee applies insatiable determination to settle on a choice on whether to supplant the current nourishment source in memory utilizing new sustenance source or not.

At that point, the likelihood esteem Pi is figured for every sustenance source in light of its wellness sum utilizing the accompanying eqn. (5.2), Where *CS* is the colony size.

$$P_i = \frac{fit_i}{\sum_{i=1}^{CS/2} fit_i} \tag{5.2}$$

5.2 Proposed ABC Scheduling for Multi-Period DTO of EOL Products

So as to acquire the most extreme yield from the reverse logistics of E-O-L items the D-T-O is an essential strategy. In D-T-O prepare the looked for parts or materials are ousted proficiently from the reclaim E-O-L items. However, the D-T-O is one of the hardest methodologies while playing out the E-O-L RL. In the past, work have proposed an Adaptive Genetic Algorithm (AGA) based strategy for choosing the appropriate number of E-O-L to reclaim for the D-T-O (T. Sathish and J. Jayaprakash, 2015). The past work adequately lessened the operational cost of the RL procedure of E-O-L items by choosing the best possible blend of parts.

This chapter, proposes a novel strategy to suitably plan the close thing for D-T-O prepare, so that the time required for the destroying get decreased meanwhile honest to goodness planning can likewise diminish the aggregate cost needed for the RL operation. The proposed structure for planning depends on the counterfeit honey bee province algorithm (ABC). The development displaying for the proposed structure gives in Fig 5.2.

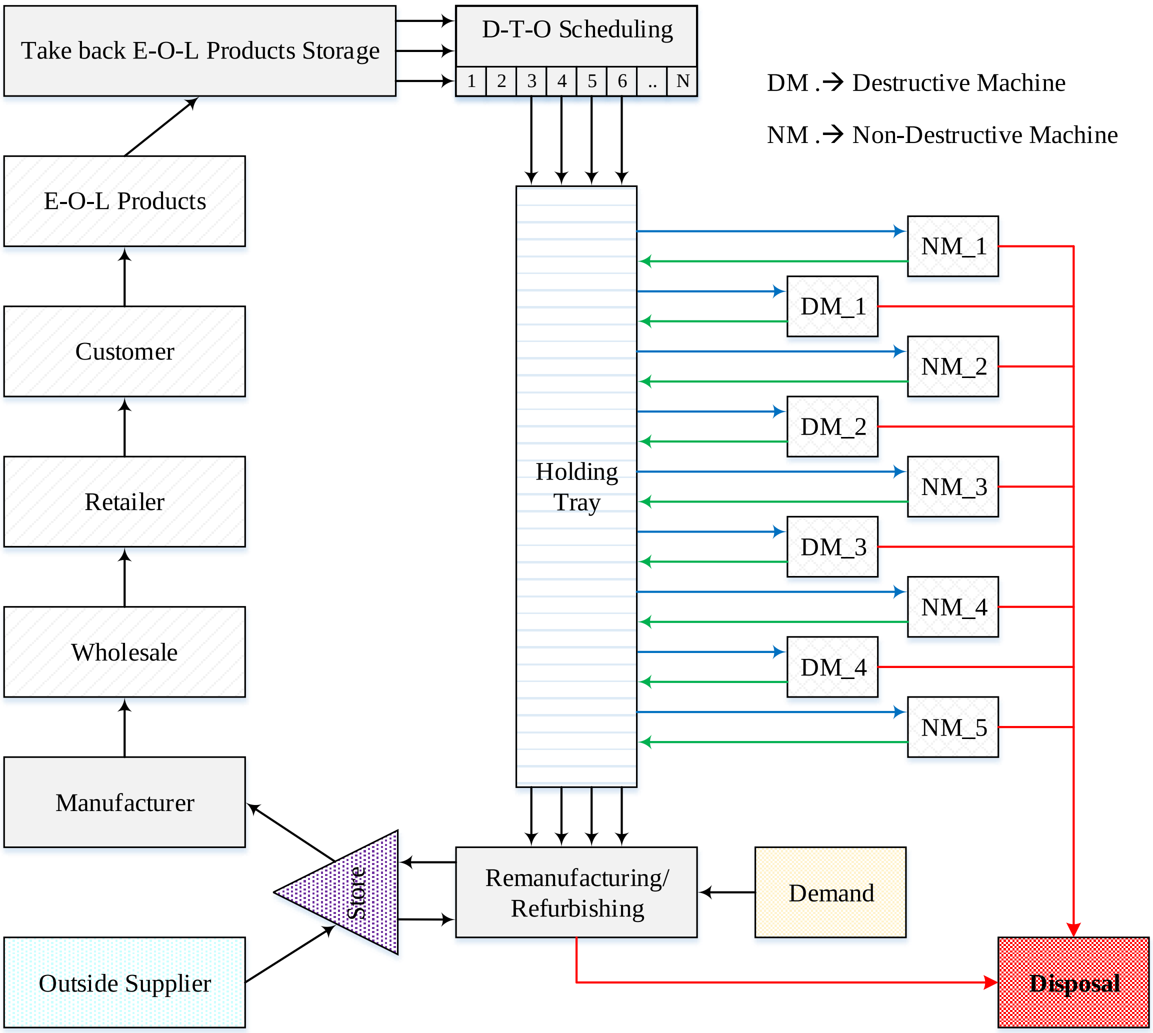

Figure 5.2. Architecture for Proposed Scheduling Strategy

Destroying can be particular, finished, destructive, non-destructive, et cetera. In this thesis, concentrating on the destructive and non-destructive dismantling of E-O-L things. The Fig 5.2 shows the proposed D-T-O, correspondingly the things prohibited from destructive dismantling sent for arranged. Besides, the dismantled parts not fulfilled the request, those need to buy from an outside provider. The ideal number of items to gather the entire E-O-L item is done in previous chapter by using AGA. In this article, the planning based framework for an ideal dismantling, to reduce the dismantling time and expand the advantage.

5.2.1 Formation of Objective Function

The objective is to predict the probability of amount of yield can occur from the dismantling of E-O-L products in reverse logistics. Fig 5.2 shows the development displaying of the D-T-O, the different items under particular condition kept in the accumulation point. Something else, to fulfil the request the parts need to buy from the outside providers. If the bona fide yield is lower than the desired, parts need to purchase to deal with the request. In another situation the yield is higher than the desire; the excess segments need to arrange. Along these lines, if the figure is far minimum or more extraordinary than it makes adversity for the E-O-L reverse logistic operation. Along these lines, the figure ought to close to the certified yield.

The aggregate time required for the dismantling of the destructive path and the aggregate time required for the dismantling of the non-destructive segment can distinguish by utilizing the accompanying eqn. (5.3) and eqn. (5.4) individually.

$$T_{Di} = \sum_{i=0}^{N} \left(\left(EP_i - NDY_i \right) \times t_{DM\_j} \right) \tag{5.3}$$

$$T_{Ni} = \sum_{i=0}^{N} \left(\left(NDY_i \right) \times t_{NM\_i} \right) \tag{5.4}$$

Where, 'T_{Di}' the disassembling red for disassembling of i^{th} destructive disassembling($\sec$); 'T_{Ni}' is time required for disassembling of i^{th} Non-destructive component ($\sec$); 't_{DM_j}' is average time taken by machine j for disassembling of a destructive component ($\sec$); 't_{NM_j}' is average time taken by machine j for disassembling of a non-destructive component ($\sec$); 'EP_i' is total E-O-L products in unit; and 'NDY_i' is Non-destructive disassembly yield in %.

The fundamental goals of our model are to limit the aggregate cost and dismantling time, the capacity for the aggregate dismantling time is given in the beneath eqn. (5.5) and aggregate cost can be computed by utilizing eqn. (5.6).

$$T_{DTO} = \sum_i \left(EP_i \cdot \left(T_{Di} + T_{Ni}\right)\right) \tag{5.5}$$

Where, 'T_{DTO}'- total time required for D-T-O ($\sec$); and $T_{Di}, T_{Ni} > 0$.

$$TC = \sum_i (EP_i \cdot bc_i) + \sum_j (pc_j \cdot PC_j) + \sum_j (dc_j \cdot DC_j) \tag{5.6}$$

Where,

$$PC_j = \max[RUD_j - \sum_i (EP_i \cdot NDY_j);0]$$

$$DC_j = \max[\sum_i (EP_i \cdot NDY_j) - RUD_j;0]$$

$$EP_i, PC_j, DC_j \geq 0$$

'bc_i' - unit take-back cost for product i (Rs/Unit)

'pc_j' - unit procurement cost for component type j (Rs/Unit)

'dc_j' - unit disposing of cost for component type j (Rs/Unit)

'PC_j' - Total no of Procured Components in unit;

'DC_j' - Total no of Disposed Component in unit;

'RUD_j' - jth type Reuse component demand in unit;

'EP_i' - i type total E-O-L products in unit;

'NDY_j' - Non-destructive disassembly yield in %

The eqn. (5.5) is the aggregate time required for the D-T-O prepare in the E-O-L reverse logistics. At that point, the target of this work is to limit the aggregate time and aggregate cost needed for the dismantling procedure. Limiting of the aggregate DTO time work turns into a random assignment when all is said in one case since it might contain different item and segment. Henceforth streamlining is favored for explaining the planning assignment. In this work, picking the manufactured artificial bee colony (ABC) streamlining for tackling the barking issue. The detailed discussion on the traditional ABC gave in the area underneath.

5.2.2 ABC based Disassembly Scheduling

The simulated honey bee state algorithm, comprises of three sorts of counterfeit honey bees, which employed, spectators and scouts. The employed honey bees gather the nourishment source frame the worldwide inquiry. The employed honey bees offer information with the passerby honey bees that hold up in the hive and watching the moves of the employed honey bees. The spectator honey bees will then pick a nourishment source with probability comparisons to the way of that sustenance source. Scout bumble bees examine for new sustenance sources subjectively in the district of the hive.

Right when a scout honey bee finds a sustenance source, it gets the chance to be employed. Exactly when a sustenance source has abused, all the employed honey bees associated with it will give up the position and may get the opportunity to be scouted yet again. Therefore, scout honey bees play out the control of 'examination', while utilizing and spectator honey bees play out the work of abuse', which energies the work of the scout bees arrangement. In the proposed algorithm, a nourishment source identifies with a possible answer for the streamlining issue, and the nectar measure of a sustenance source looks at to the wellbeing of the related arrangement.

In ABC, a vast part of the province contains employed honey bees, and the other half are onlookers. Some employed bees are proportional to some sustenance sources in light of the way that it is normal that there is one and just employed honey bee for each nourishment source. Subsequently, the amount of passerby honey bees is moreover identical to some arrangements under thought. The ABC algorithm starts with a social event of randomly made sustenance sources. The guideline philosophy of ABC can be portrayed as takes after.

5.2.2.1 *Initialization phase*

In this underlying period of ABC algorithm, the food sources have been haphazardly created.

$$F_i = \{F_{i,1}, F_{i,2}, \mathrm{K}\ , F_{i,D}\} \tag{5.7}$$

F_i Represent the i^{th} food source, which is obtained by

$$F_{i,d} = F_d^{\min} + r \times \left(F_d^{\max} - F_d^{\min}\right) \tag{5.8}$$

Where r is a uniform random number in the range $[0,1]$ and $F_d^{\min}$ and $F_d^{\max}$ are the lower and upper bounds for dimension d respectively $d = 1, \ldots, D$.

5.2.2.2 *Employed bee phase*

In this stage, each employed honey bee associates with an answer. It applies an irregular change on the answer for the new arrangement. It executes the limit of neighborhood inquiry. The new solution v_i is created from F_i utilizing a differential expression:

$$s_{i,d} = F_{i,d} + r' \times \left(F_{i,d} - F_{k,d}\right) \tag{5.9}$$

Where d is randomly selected from $\{1, \ldots, D\}$, k is randomly selected from $\{1, \ldots, SN\}$ such that $k \neq i$, and r' is a uniform random number in the range $[-1,1]$. Once s_i is obtained, it will be evaluated and compared to. If the fitness of s_i is better than that of x_i, the bee will forget the old solution and memories the new one. Otherwise, she will keep working on x_i.

5.2.2.3 *Onlooker bee phase*

At this stage, when the employed honey bees have finished their neighborhood seek, they share the nectar information of their source with the spectators, each of whom will then pick a nourishment source probabilistically. The probability Pb_i by which an onlooker bee picks food source x_i is computed as takes after:

$$Pb_i = \frac{f_i}{\sum_{t=1}^{SN} f_i} \tag{5.10}$$

Where f_i is the fitness value of x_i. Obviously, the onlooker bees tend to choose the food sources with higher nectar amount. Once the onlooker has selected a food source x_i, it conducts local search on x_i according to eqn. (5.9). As in the previous case, if the modified solution has a better fitness, the new solution will replace x_i.

5.2.2.4 *Scout bee phase*

In the scout honey bee period of ABC, if the nature of an answer can't be enhanced after a foreordained number (farthest point) of the trials, the nourishing source is thought to be deserted, and the comparing employed honey bee turns into a scout. The scout will then deliver a nourishment source arbitrarily by utilizing eqn. (5.8).

In this stage, if the way of an answer cannot be improved after a destined number of trials, the sustenance source is thought to be surrendered, and the relating employed honey bee transforms into a scout. The scout will then make a sustenance source indiscriminately by using eqn. (5.8).

5.3 Results and Discussion

The proposed strategy for the ideal booking of D-T-O in E-O-L reverse logistics in light of ABC algorithm is executed in the working stage of MATLAB 2014a, with the framework arrangement; Intel Core i5 processor, 8GB RAM and Windows 8.1 working framework.

In this chapter, employed the data used as a piece of the previous chapter. For this circumstance representation, thinking about 100 E-O-L items, and each item contains nine segments. The parts sort thinking about is PC, and the segments are numbered from 1 to 9, the detail of segments is given in Table 4.1.

The objective of the past work was to make 20 new items from the available 100 E-O-L items. In flawless case secure the best number of E-O-L parts is 900 for 100 items. Be that as it may, in rational case it is unrealistic, because of the missing items. From the data used as a piece of this chapter the most outrageous no of open parts is 463 including both destructive and non-destructive. In this the best open non-destructive parts are 200 and destructive parts are 263. The total non-destructive parts can be particularly used for the reuse with less measure of adversity. A segment of the destructive segment in the wake of remanufacturing or reusing it can be used for the reuse.

To make 20 new items require 180 sections i.e. 20 numbers of each segment sort are required. To satisfy our need to take most extraordinary of 55 E-O-L things. Remembering the ultimate objective to pick the most reasonable blend, to diminish the total cost the AGA was used. The execution of the proposed system is differentiated and the present strategies like transformative programming (EP) and genetic algorithm (GA).

From the relationship, the total no of reclaimed things by our proposed AGA strategy is 47, which are 6 numbers not precisely GA and eight numbers not precisely EP. The total destroying cost by AGA approach is 30 $, which is 5 and 8 dollars, not as much as that of GA and EP independently. The total obtaining cost by AGA strategy is 25$ which is one dollar not precisely both GA and EP. The total cost for the direct inverse logistic by proposing AGA procedure is only 525$ yet for GA and EP is 591 and 614 separately.

In this part, thought to decrease the dismantling time of the E-O-L items so that an ideal, booking structure in light of ABC algorithm is proposed. Here 47 items as the information item, for the dismantling, which are the reclaim E-O-L PCs. Every item has 9 segments, add up to accessible machines is 9 among 4 for dismantling the destructive segment and 5 for non-destructive segments. The normal time taken by the different machines is given in Table 5.1.

Table 5.1: Average time taken by the various machines

Non-destructive Machine	Time (Sec)	Destructive Machine	Time (Sec)
NM_1	33	DM_1	11
NM_2	36	DM_2	9
NM_3	35	DM_3	13
NM_4	40	DM_4	14
NM_5	32	------------------------	-------------

The Table 5.1 demonstrates that the dismantling machine required more opportunity for dismantling non-destructive machine than the destructive machine.

Since non-destructive dismantling needs to maintain a strategic distance from harm of parts. The greatest normal time required for the dismantling of the non-destructive segment is 40seconds and least required time is 33 seconds for the given items. Then again, for the dismantling of the destructive part machine required most extreme of 14 seconds and least of 9 seconds. So as to approve the viability of the proposed framework the proposed framework is contrasted and the Evolutionary Programming (EP) and Genetic Algorithm (GA) as far as dismantling. The dismantling time correlation is given in Table 5.2.

Table 5.2: Comparison of Disassembly time for the 47 products

No of E-O-L Products	Disassembly time (Sec)		
	Proposed	GA	EP
47	223	247	280

Table 5.3: Comparison of Total Cost for the 47 products

No of E-O-L Products	Total Cost ($)			
	Proposed	AGA	GA	EP
47	498	525	591	614

The dismantling time of the different method for the D-T-O of 47 items got from the past work is given in Table 5.2. The aggregate time required for the dismantling of 47 items by the proposed optima booking algorithm is 223 seconds and by utilizing alternate strategies like GA and EP is 247 and 280. It is obviously demonstrated that the proposed booking system can be a superior choice for the dismantling of E-O-L items in brief time. In Table 5.3 the aggregate cost required for the D-T-O of 47 items is given. The aggregate cost required for the dismantling of 47 items is 614, 591, 525 and 498 by utilizing EP, GA, AGA and proposed are respectively.

The Table 5.4 and 5.5 demonstrate that the utilization of time and cost for the dismantling of 47 items is better and low by utilizing the proposed ABC based planning method. Keeping in mind the end goal to demonstrate the planning, execution of the proposed structure, it is contrasted and the other booking algorithm by differing the quantity of E-O-L item and is given in Table 5.4.

Table 5.4: Comparison of scheduling algorithms regarding Disassembly time

No of E-O-L Products	Disassembly time (Sec)		
	Proposed	GA	EP
30	196	215	249
40	202	221	266
50	237	261	298
70	256	289	320
100	310	345	382

Table 5.5: Comparison of scheduling algorithm regarding Total Cost

No of E-O-L Products	Total Cost ($)			
	Proposed	AGA	GA	EP
30	448	475	516	563
40	487	502	578	597
50	505	533	602	620
70	536	558	645	656
100	585	591	689	702

The Table5.4 gives the examination of the booking algorithm by fluctuating the quantity of item. The time required for the dismantling of the 30, 40, 50, 70 and 100 items is 196, 202, 237, 256, and 310 individually by proposing strategy, 215, 221, 261, 289, and 345 separately by GA and 249, 266, 298, 320, and 382 separately by EP algorithm.

In Table 5.5 the different planning algorithm as far as aggregate cost is thought about the relative investigation unmistakably demonstrates that the aggregate cost required by proposed algorithm is lower than that of alternate past and existing algorithms. The graphical portrayal of the planning algorithm examination as far as both dismantling time and aggregate cost is given in Fig 5.3 to Fig 5.9.

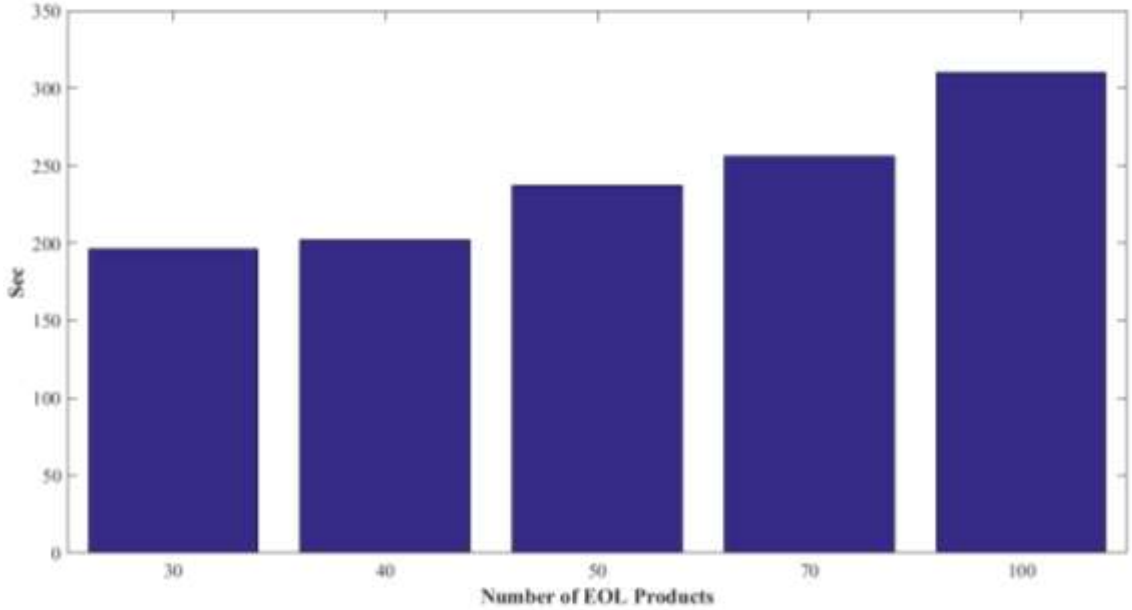

Figure 5.3. Comparison of proposed scheduling in terms of disassembly time

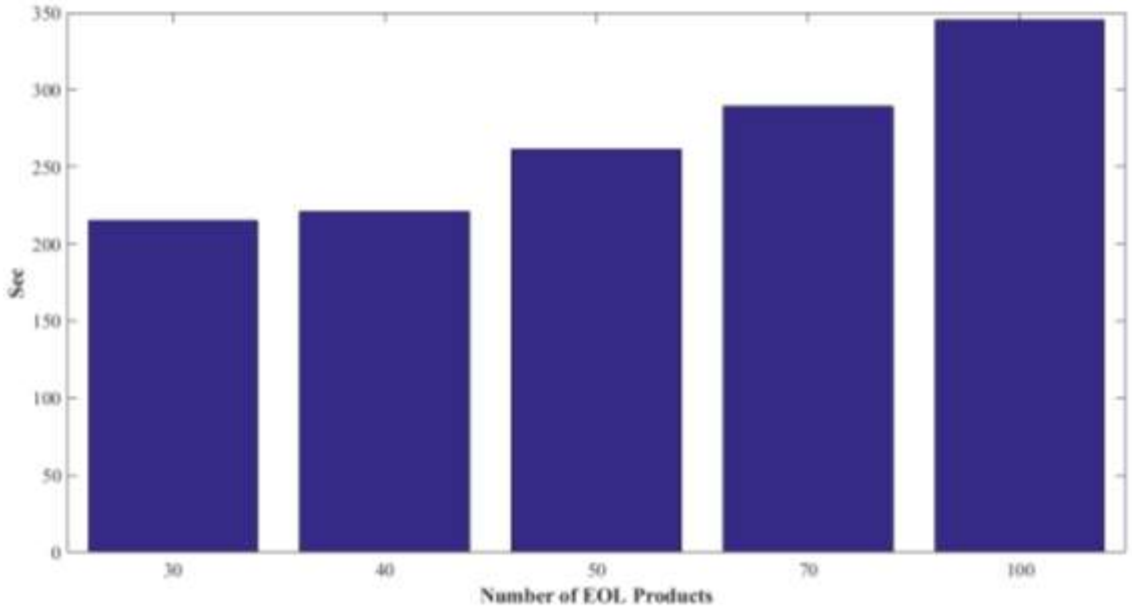

Figure 5.4. Comparison of GA based scheduling regarding disassembly time

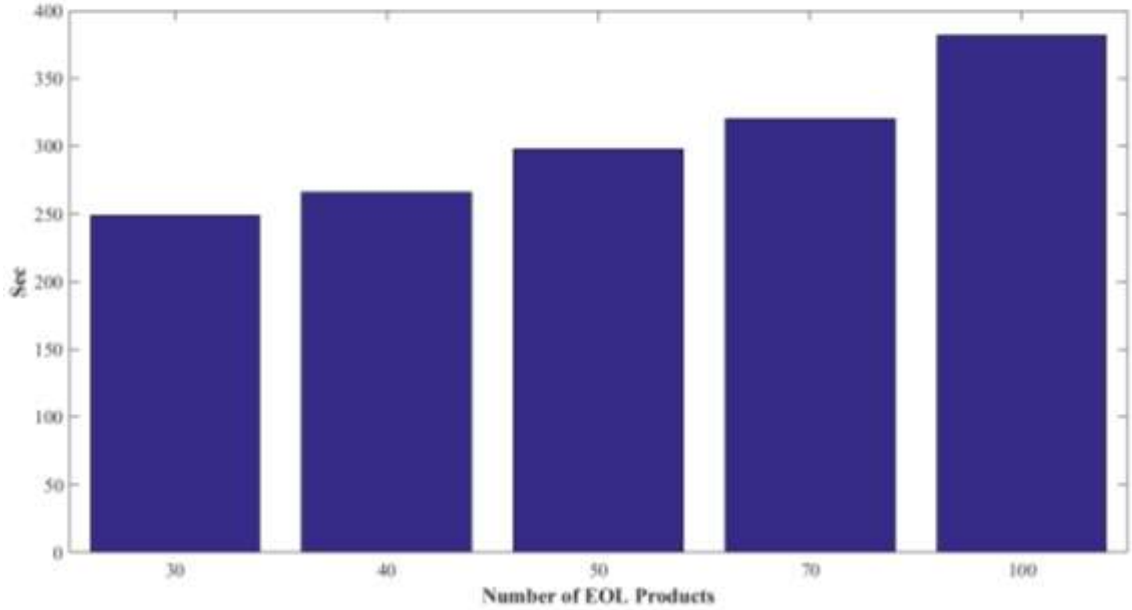

Figure 5.5. Comparison of EP based scheduling in terms of disassembly time

The Fig 5.3 to Fig 5.4 the dismantling time correlation of different strategies at various no. of E-O-L items is given.

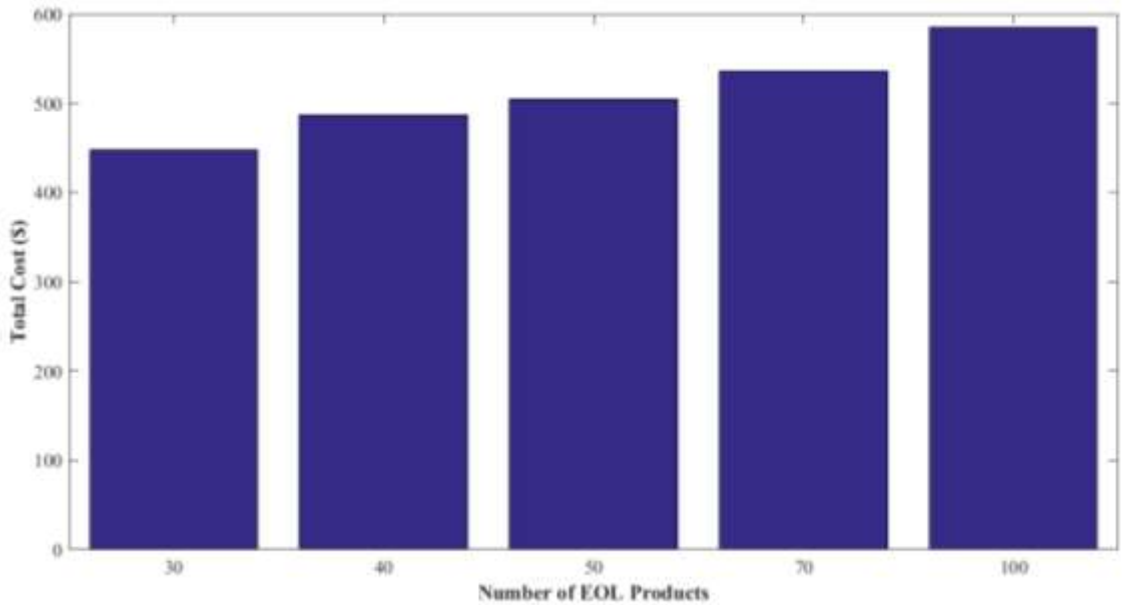

Figure 5.6. Total cost at variable no. of E-O-L products by proposed

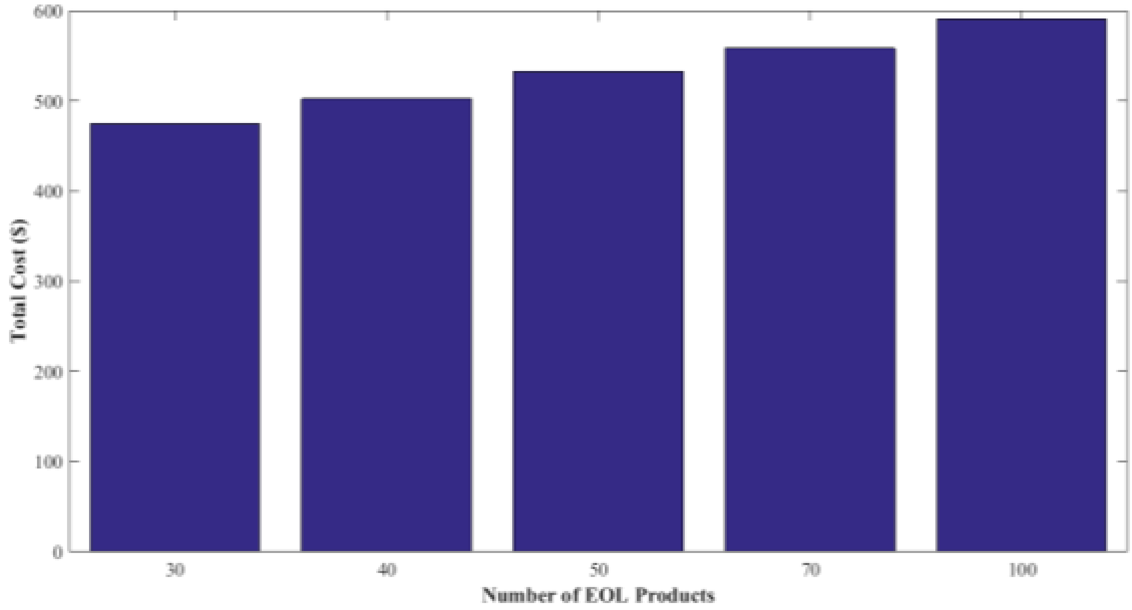

Figure 5.7. Total cost at variable no. of E-O-L products by AGA

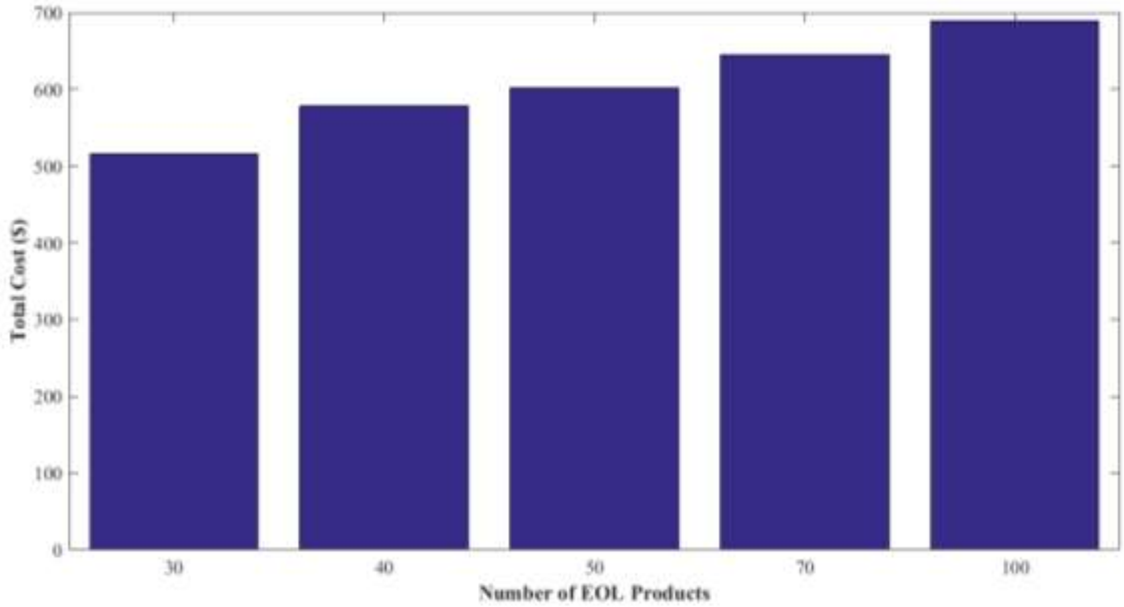

Figure 5.8. Total cost at variable no. of E-O-L products by GA

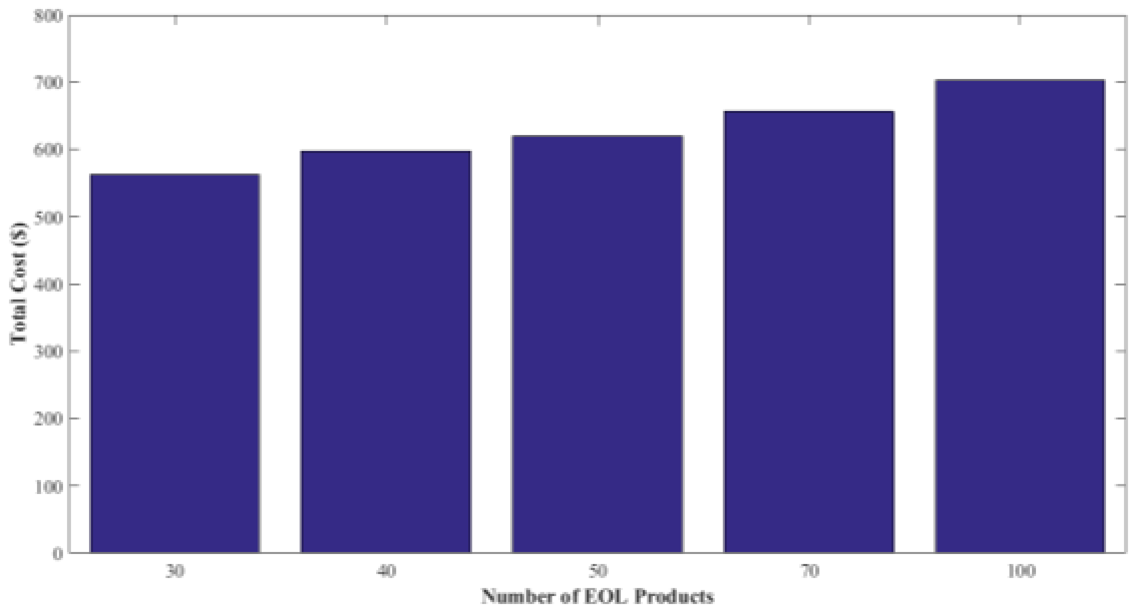

Figure 5.9. Total cost at variable no. of E-O-L products by EP

The execution correlation diagrams given in Fig 5.3 to 5.9 plainly demonstrates the adequacy of the proposed system for the dismantling booking of E-O-L item in the reverse logistics operation. The merging appears the viability of streamlining algorithm.

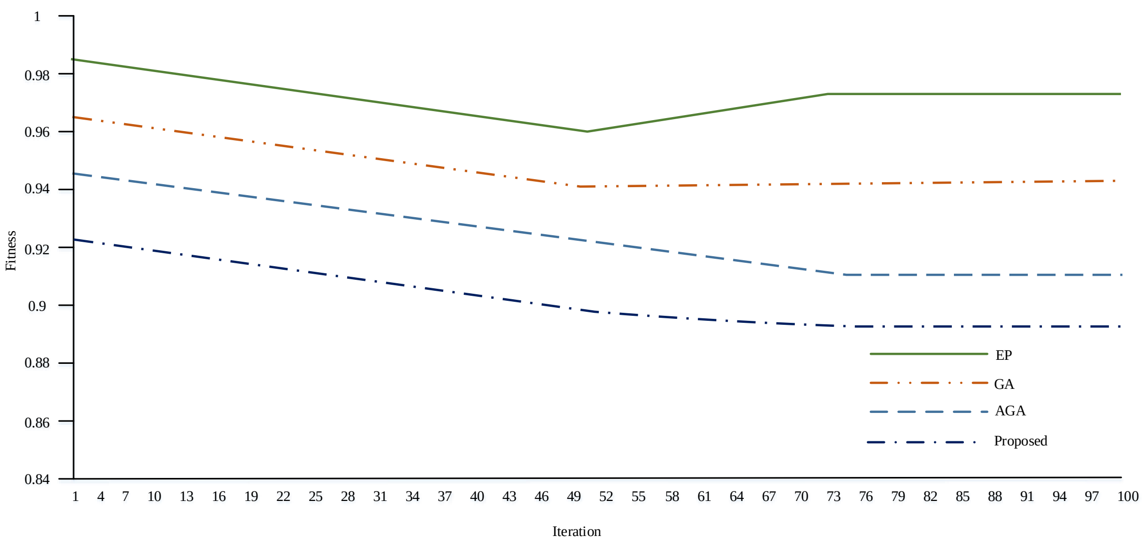

Figure 5.10. Convergence

The convergence chart given in the Fig 5.10 demonstrates that the proposed enhanced algorithm for the planning is merged well contrasting with alternate strategies like GA-based booking and EP based planning. The exploratory outcomes and execution investigation talked about up until now, demonstrates that the proposed structure for the dismantling planning of E-O-L item in reverse logistics can turn into an appropriate method to improve the speed of RL process so that the greatest benefit can accomplish.

In the current chapter an artificial bee colony based strategy is proposed for the multi period disassembly in manufacturing industry. The proposed strategy is provided better performance in terms of time and cost. But the convergence rate of optimizer used in the strategy is not up to the mask. So in the next chapter (chapter 6) a hybrid metaheuristic approach is proposed to improve the convergence rate of the optimizer. By improving the convergence rate of an optimizer, the overall performance such as time and cost can also improve.