Chapter 8

Conclusion and Further Work

8.1 Introduction

Previous chapter presented the evaluation strategy and other details on setting up, choosing parameters and conducting the experiment. It also presented the results obtained. This chapter presents the conclusion of the research and while discussing the results obtained in the previous chapter.

8.2 Conclusion

From the results, it can be seen that, if any seller system can adapt to the dynamic changes of the market, it can earn more revenue. All the statistics collected show that, Base case revenue is out performed by other cases such as adaptive bargaining and adaptive pricing no matter the nature of the customer demand fluctuates and supplier or the tour operator has been able to generate around 15% more revenue. The accurate forecasts of customer bid price movement and number of bids that can receive in the future also play a crucial role. The forecasts, which were available after first two cycles showed outstanding performance and that helped to collect significant more revenue.

After studying about the revenue management in detail, it has been clear from the literature review that, problem of managing revenues in complex business processes remains challenging. Even though there are number of efforts carried out to model business processes like supply chain management, no complete system available which fulfill the requirement of revenue management, which is, adapting to the highly dynamic market. Different negotiation methods also studied to find out an appropriate mechanism to suit for such a complex business scenario where re contracting and de-commitment seems to be imminent. Various multi agent approaches also studied which are developed to model and simulate online market places but they are not as complex as what actual tour operation business is. Hence, the problem of managing revenues in dynamic markets remained unsolved.

In finding out a technology to solve such a problem, various approaches in modeling similar business processes studied and it was found that, multi agent technology is the most appropriate technology to solve such a problem. That is mainly because, multi agent technology is the classic approach suggested in the literature to model complex processes.

After finding out a technology, approach was developed to solve the problem having the complexity as the basis for the theory. Inputs, outputs, process, users and features indentified accordingly. The key difference in this particular approach is, identifying number of autonomous entities representing different mandatory aspects of a complex business process. Those are the elements which seem to be missing in other available agent models to solve similar problems. In successful implementation of the proposed approach, every aspect of the tour operation will be considered. On the other hand, proposed approach comprises features like demand forecasting, adaptive bargain handling, and adaptive pricing. Such features are already a valuable requirement in the currently available software. Hence, this proposed approach will not only provides a model for complex tour operation business but also provides other features like above.

Design has been prepared starting from the top level architecture and going down to individual agent level. Two main levels of communication have been identified. First level is, between tour operators/suppliers and the customers and the second within the tour operator's organization. Customer request come from the global communication while competitor prices are also extracted from there too. Once the global purchase or booking request reaches local environment, different agents start reacting to serve the request. In doing so, system automatically adjust to the nature of customer requests. Sometimes, existing rules for pricing might have to be relaxed to maintain revenues or to fulfill inventory. Hence, in the local environment, tour operator dependent ontology is available which contains how to relax such rules.

In progressing with the implementation, MADKit has been selected to simulate the proposed agent system. That is due to the fact that, that toolkit provides faster implementation approach. Other features are user interface for managing agents, support for Java programming language and documentation being available. Ontology

was defined as a java class structure. One of the areas where implementation was not made complete is the ontology for the agents to operate. Even though the original intention was to define comprehensive global travel ontology, with the time available, that could not be completed. The ontology for the prototype developed contains an ontology which is a java class structure.

The evaluation was then performed using the developed prototype. The whole evaluation was based on four cases where from first case to the last, features of the system increase. Those cases were evaluated with different customer demand behaviors in number of consecutive cycles. Finally results collected and presented in charts with comparisons. Results clearly showed noticeable (around 15%) increase revenue when adaptive strategies are followed by the supplier or the tour operator.

8.3 Problems encountered

During this research, one of the main problems encountered is, finding a successful forecasting technique. Alternatives available were either to use statistical techniques or to use artificial neural network techniques. Since literature strongly recommended neural networks only if statistical techniques fail, statistical techniques had to be studied first. So, during the course of research, statistical forecasting techniques were also studied and triple exponential smoothing technique was selected since it generated accurate forecasts.

One another problem encountered during the research is, less knowledge in economic side of particular business. I.e. every product sold in market has economic demand. That demand controls the price and number of units that can be sold for that price. This theory had also to be studied in detail modeling a revenue management solution.

8.4 Future work

Extending the work done up to now, to model other business process, while having this prototype as the basis would be quite valuable. On the other hand, the ontology can be fed with more forecasting and other algorithms for negotiations and price adjustments. That way, system will have more alternatives it can choose on the fly in making price adjustment decisions.

8.5 Summary

It was concluded in this chapter that, if any seller system can adapt to the dynamic changes of the market, it can earn more revenue, which can be as much as 15% increase compared to a system which does not adapt. Further it was presented a summary of the work carried out throughout the research work with also the problems encountered. Finally, future work was presented.