Journal of Network and Information Security
10 (2) 2022, 21-25
http://www.publishingindia.com/jnis

Design and Implementation using of B2B Bot using Game and Queuing Theory

Tasmiya Mansoor[1], Varshini B. R.[1], Y. Ashritha Bhat[1], Vivek Srinivasan[1] and Samara Mubeen[2*]
[1]Department of IS&E, JNNCE, Shivamogga, Karnataka, India.
[2]Assistant Professor, Department of IS&E, JNNCE, Shivamogga, Karnataka, India.
Email: samaramubeen@jnnce.ac.in
*Corresponding Author

Abstract: E-commerce is an online platform for purchasing and selling goods, products, and services. All of the transactions are done through the internet. Transaction costs will be significantly reduced as a result of electronic commerce. B2B, B2C, and C2C E-commerce are some of the several categories of E-commerce. B2B E-commerce is becoming more popular. B2B E-commerce companies require persuasive communication with their customers. Because commerce is conducted online, identifying trustworthy E-stakeholders is difficult. In B2B E-commerce, game and queuing theory is applied to identify trustworthy E-stakeholders. Information from E-stakeholders is gathered for specific products. Game theory is utilised to identify trustworthy and genuine E-stakeholders. A dataset is created as a result of this. Based on specific parameters, queuing theory is applied to determine the lead time of E-stakeholders. B2B Bot assists in the identification of trustworthy and genuine E-stakeholders

Keywords: B2B Bot, Game theory, Queuing theory.

I. Introduction

E-commerce is the term used to describe the purchasing and selling of goods, products, or services over the internet. Other names for E-commerce include internet commerce and electronic trade. The internet is used to deliver these services. E-commerce refers to transactions involving money, cash, and data. The four forms of business interactions are business-to-business (B2B), business-to-customer (B2C), customer-to-customer (C2C), and customer-to-business (C2B). B2B E-commerce describes exchanges that happen across platforms like Rosetta Net and BizTalk between all business parties. B2C refers to a transaction between a company and a customer. C2C E-commerce refers to client-to-client transactions like those made by Quickr and Jabong. Understanding situations where decision-makers are involved is aided by game theory. A game is, according to the usual definition, "A Competitive Activity." A set of rules govern the competition between players. There are numerous uses for it, some of which are listed below: competing businesses for customer's Political candidates battling for votes, predators struggling for their prey, auction bids competing, football players taking penalties. The list is endless. Constant Sum, Zero Sum, and Non Zero Sum Games, Symmetric and Non-Symmetric Games, Normal Form and Extensive Form Games, Simultaneous Move Games, and Sequential Move Games.

Queuing theory is the mathematical analysis of standing in a line or queuing. Queues are composed of "clients" like individuals, things, or data. Queuing theory examines the arrival process, service process, number of servers, number of system spaces, and number of clients, which could be humans, data packets, or autos. In order to create services and systems that are more effective and economical, congestion and its causes are researched. Staffing, scheduling, and customer service problems can be helped by queuing theory, which is commonly used as an operations management technique. In the workplace, standing in line occasionally is appropriate. If there is never a line, there is overcapacity. In the workplace, standing in line occasionally is appropriate. If there is never a line, there is overcapacity. Queuing theory aims to achieve a balance between efficiency and cost effectiveness. In order to identify and remove bottlenecks in a process, queuing theory is applied. The line may consist of individuals, things, or data. In any event, they must wait for assistance.

Input source, queue discipline, and service mechanism make up the characteristics of the queuing system. The size of the input source is one of its characteristics. The size is the total number of units that could occasionally need maintenance. Either unlimited or finite can be assumed. The customer's presumption is that they create at a specific average rate in accordance with the "Poisson Distribution." The corresponding premise is that they generate in accordance with an exponential distribution between successive arrivals. Use and assume that the consumer population is to solve the issues. A queue's

maximum allowable number of units that it can contain defines its queue discipline. Depending on whether a number is finite or infinite, queues are referred to as finite or infinite. The sequence in which a particular queue is chosen for service is referred to as the service discipline. Ex: Unless otherwise stated, FIFO is typically assumed; it may be random or priority service system. There are one or more service facilities involved in this, and each one of them has one or more parallel service channels. The arrival unit may receive the service from a series of service channels if there are many service facilities. The arrival reaches the service area of a certain facility and is entirely served by that server. The service time for a unit at the service facility is the period of time from the start of the service to its completion. Typically, the service time exhibits an exponential distribution.

One of the most popular types of games in game theory is the simultaneous game, in which both players move at the same time (or, if they don't, the later player is unaware of the earlier player's action, making it simultaneous). In normal form, which consists of a N x N matrix with each entry being a 2-tuple indicating the prize for each respective player in a game with two players and N possible plays for each player, sequential games are usually represented. To understand what I mean, look at the example below. In the sequential game "The Prisoner's Dilemma," each prisoner must decide between covering up for the other prisoner and expecting that the other prisoner will do the same, or betraying the other prisoner in exchange for a lesser sentence (Confess) (Lie). Each column in the matrix contains the first element of the tuple, which represents the payout for Prisoner 1, and the second element, which represents the payout for Prisoner 2. Find the matrix entry that corresponds to the row and column that each participant will choose (Confess or Lie) before beginning to read this reward matrix.

Paper is organized as follows: Introduction in section I, literature review in section II, system design in section III, implementation in section IV followed by conclusion in section V.

II. Literature Review

Maria D. Illescas-Manzano, Noel Vicente Lopez, Nuno Afonso González and Carmen Cristofol Rodríguez, "Implementation of Chabot in Online Commerce, and Open Innovation," This research work takes a step further and shows that implementing a chatbot through the Many Chat platform by a company that markets online has a positive impact on the capturing of leads [1]. A chatbots platform used with the intention of obtaining leads seems to be an agile and powerful tool; in fact; the main conclusion of this work is that including this method can be one of the main axes of obtaining information about consumers with the aim of performing marketing actions in a two-way communication that facilitates sales by companies.

Jeannette Paschen, Ulrich Paschen, Erol Pala and Jan Kietzmann, "Artificial Intelligence (AI) and Value Co-Creation in B2B Sales: Activities, Actors and Resources," This study identifies the value Co-creation process, and provides an understanding of the actors, activities and resources during the usage of AI to create value in B2B sales [2]. The study also identifies several limitations of AI, such as; value Co-creation is heavily dependent on human activities and resources. Lastly, it is suggested that managers continue to manage customer expectations when using AI for value Co-creation and highlight the necessity of human actors and resources in the value Co-creation process.

Barbara Robert, "Stakeholder Power in E-Business Adoption with a Game Theory Perspective," The likelihood that one organization can pressure the E-business adoption practices of other organizations depends on two conditions: there must be sufficient power difference between the organizations; and the E-business process benefit must be sensitive to the number of adopters. Given these two conditions, the powerful organization can use their power advantage to control adopter numbers through urging or suppressing adoption by others [3].

M. J. Tarokh, S. Sohrabi and H. Shahriari, "B2B Electronic Market Analysis using Game Theory," In this paper the expected profit function for each market participant has been defined in a neutral market based on double auction. Also, the model is simulated and results are shown [4]. They suggested that the implementation of B2B E-commerce is time consuming and the long-term impact on an organization may be unclear for some time. In the research by Wang and Benaroch (2004), a mathematical model is introduced that compared the condition of buyers and sellers in both online (electronic) market and offline (traditional) market.

Dinh Son Nguyen, "Application of Queuing Theory in Service Design," An approach based on the queuing theory is proposed in this paper to solve these problems [5]. A mathematical model analysis to determine the important parameters as the mean waiting time, number of service platforms, and probability of customer waiting in queue is presented in the paper. Thus, the waiting time of customers is a very important factor influencing on the quality of designed service. In addition, a method to minimize the waiting time regarding to constraints from the requirements of customer will be presented in the paper. As a result, an application of customer service design in a bank company is also presented.

Liu Changfu and Liu Zhenyu, "Research of Transaction Request Handling Queuing Systems in the E-Business Environment based on Queuing Theory," The theoretic conclusion and simulation output have proved that the structural adjustment of queuing systems in the E-Business environment can reduce customer mean waiting time along with the simplicity of input

and output of documents, and then improve customer service experience. This article had also studied a more common situation of customer arrival which has the characteristic of peak period distribution [6]. The simulation result indicates when the customer inter arrival times have the characteristic of peak period distribution, the decreased mean waiting time brought by the structural adjustment of queuing system in the E-Business environment is prominently less than the negative exponential distribution, and the efficiency improvement of request handling has been reduced, but the conclusion is still tenable.

He Sun, "Analysis on the Problems in Online Shopping Under Prisoner's Dilemma," This analyzes the behaviour and choices between consumers and the managers of E-commerce according to the game theory, thus, provide possible solutions to reduce the problems caused by lack of trust between consumers and sellers to improve the E-commercial environment and give a better online shopping experience for everyone. This situation can be assumed as a Prisoners Dilemma game. In this game, buyers and sellers are the two sides of the players. Both of them are rational and self-interested. Additionally, each group of the buyers and sellers play the game once and they will change their partner in the next game. Also, it is assumed that buying and selling the good happens at a same time [7].

Jianya Zheng and Li Weigang, "A Game-Theory based Model for Analyzing E-Marketplace Competition," The current E-marketplace provides many tools and benefits that bring sellers and buyers together, and promote trading within cyberspace. And due to certain unique features of E-commerce, the competition also takes on characteristics different from those found in traditional commerce. This paper analyses both the competition between sellers, and the stable state in E-marketplace through a proposed model that applies evolutionary game theory [8]. The purpose is to better understand these relations and the current state within E-marketplace, as well as provide a tool for sellers to increase their profits.

A. O. Akingbesote, M. O. Adigun, S. S. Xulu and E. Jembere, "Performance Evaluation of Cloud E-Marketplaces using Non-Pre-Emptive Queuing Model," E-marketplaces can be referred to as the virtual environments for buying and selling of services. It differs from the traditional marketplaces in that the business transactions occur with the use of communication networks without the clients and the producers seeing each other. This virtual, dynamic and real-time platform allows the consumers or the clients and the producer to have a better communication with the use of the Internet technologies. Hence E-Marketplaces are regarded as one important part of E-business solutions in the process of enabling supply chain integration to maintain the business value and growing competitive necessity [9].

M. Bichler, J. Kalagnanam, K. Katircioglu, A. King, R. D. Lawrence, H. S. Lee, G. Y. Lin and Y. Lu, "Applications of Flexible Pricing in Business-To-Business Electronic Commerce," The increasingly dynamic nature of business-to-business electronic commerce has produced a recent shift away from fixed pricing and toward flexible pricing. Flexible pricing, as defined here, includes both differential pricing, in which different buyers may receive different prices based on expected valuations, and dynamic-pricing mechanisms, such as auctions, where prices and conditions are based on bids by market participants [10]. In this paper they surveyed ongoing work in flexible pricing in the context of the supply chain, including revenue management, procurement, and supply-chain coordination.

III. System Design System Design and Flowchart of Methodology of B2B E-Commerce

The Fig. 1 shows the Generic model of B2B e-commerce. This model consists of two suppliers identified by S1 and S2, one manufacturer M1, two distributors D1 and D2 and finally two retailer's R1 and R2. Between the E-stakeholders queuing model is used. The queuing model consists of sending and receiving queue.

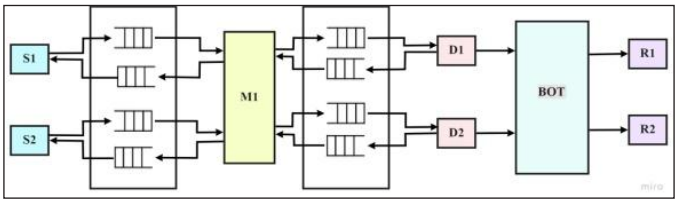

Fig. 1: Generic Model of B2B E-Commerce

Make to stock works on the assumption that a customer will require the product eventually, and thus it should be made beforehand. Make to stock on the other hand is known as a push method because the business produces a product with nothing but sales forecasts to determine what they ought to create and how much of the product ought to be created essentially; they are 'pushing' their product into customers hands. In order to get raw materials from suppliers S1 and S2, the manufacturer will make an order with the supplier for request-for-quotes (RFQ). The raw materials will be delivered to the maker by the suppliers. The manufacturer assembles the raw materials into the finished product. By sending information on the final product, the manufacturer acknowledges the distributors' and retailers' requests-for-quotes for the produce. On that basis, waiting time will be computed based on the information transmitted between the queuing model throughout the entire process of manufacturing the final product and delivering to the retailer. This data is saved and utilized to create the B2B Bot. The Fig. 2 shows the workflow of B2B Bot.

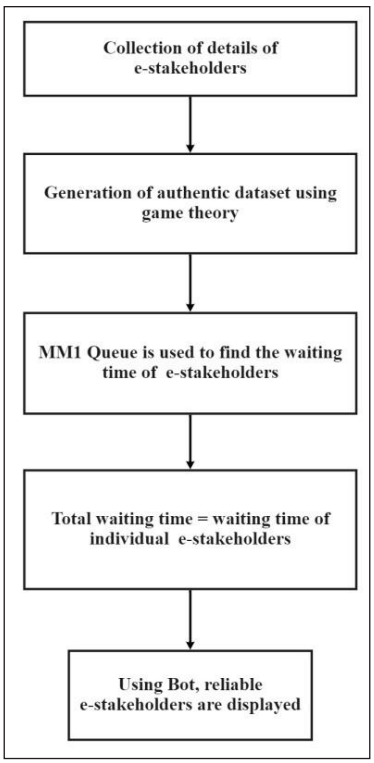

Fig. 2: Workflow of B2B Bot

To gather the details of authentic E-stakeholders, first collect the details of E-stakeholders for B2B E-commerce and then produce datasets using the game theory approach. After gathering E-stakeholder information, use the queuing concept to determine the lead time of E-stakeholders, and then calculate the total waiting time of B2B E-commerce. Bot provides information on E-stakeholders with a short waiting time. This data is utilised to create B2B designs. Workflow of B2B Bot is shown in the Fig. 2. The following are the stages of the designing of B2B Bot.

IV. Implementation and Result Analysis

Matlab is used as analytical tool for the implementation of the model. The flowchart depicted in Fig. 3 is used to implement the matching model which helped in generating the code in Matlab.

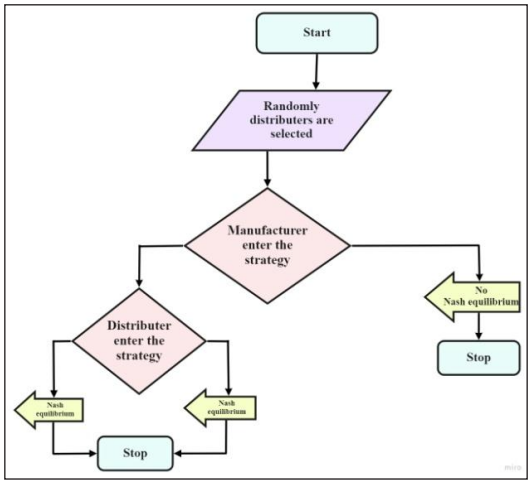

Fig. 3: Flowchart of the Matching Model

Result analysis is carried for two types of models i.e., Generic model and n-retailer model. In the generic model, only two retailers are involved in doing business with the manufacturer. The Table I depicts the iteration results for matching.

1st Iteration of the Code

Table I: Selection of Manufacturer using Extensive Game Theory with Perfect Information

Iteration	Manufacturer ID	Manufacturer Name	Pay off Matrix	Nash Equilibrium
1	10	Lenovo	$\begin{vmatrix} 15 & 57 \\ 42 & 54 \end{vmatrix}$	No Nash equilibrium
1	2	Apple	$\begin{vmatrix} 39 & 56 \\ 31 & 83 \end{vmatrix}$	[6 9]

Table II: Selection of Suppliers using Extensive Game Theory with Perfect Information

Iteration	Supplier ID	Supplier Name	Pay off Matrix	Nash Equilibrium	Total Waiting Time
1	8	Keyuda (hk) Co Ltd	$\begin{vmatrix} 68 & 94 \\ 83 & 39 \end{vmatrix}$	No Nash Equilibrium	-

TABLE III: SELECTION OF DISTRIBUTOR USING EXTENSIVE GAME THEORY WITH PERFECT INFORMATION

Iteration	Distributor_ID	Distributor Name	Pay off Matrix	Nash Equilibrium	Total Waiting Time
1	5	Lap Gadgets	| 47 55 | | 67 27 |	No Nash Equilibrium	-
1	9	Western InfoTech Private Limited	| 17 36 | | 55 12 |	No Nash Equilibrium	-
1	10	Vesta Deal	| 69 27 | | 35 34 |	[6 9]	0.2361

V. CONCLUSION

The traditional method of procuring raw materials is being replaced by an online method known as B2B E-commerce. This is carried out methodology and system design. In B2B E-commerce, this depicts the communication between E-stakeholders. The collection of datasets for future work will be done at random. Finding trustworthy E-stakeholders is done using computational models. The B2B Bot is used to predict the most effective E-stakeholders.

REFERENCES

[1] M. D. Illescas-Manzano, N. Vicente Lopez, N. Afonso González, and C. Cristofol Rodríguez, "Implementation of chatbot in online commerce, and open innovation," *J. Open Innov. Technol. Mark. Complex.*, vol. 7, no. 2, p. 125, 2021.

[2] J. Paschen, U. Paschen, E. Pala, and J. Kietzmann, "Artificial intelligence (AI) and value co-creation in B2B sales: Activities, actors and resources," *Australasian Marketing Journal,* vol. 29, no. 3, pp. 243-251, 2021.

[3] B. Roberts, "Stakeholder power in e-business adoption with a game theory perspective," *Journal of Theoretical and Applied Electronic Commerce Research*, vol. 4, no. 1, pp. 12-22, 2009.

[4] M. J. Tarokh , S. Sohrabi, and H. Shahriari, "B2B electronic market analysis using game theory," *J. Ind. Eng. Int.,* vol. 7, no. 13, pp. 44-51, 2011.

[5] D. S. Nguyen, "Application of queuing theory in service design," in *2017 IEEE International Conference on Industrial Engineering and Engineering Management (IEEM)*, Singapore, 2017.

[6] L. Changfu, and L. Zhenyu, "Research of transaction request handling queuing system in the e-business environment based on queuing theory," in *2009 Asia-Pacific Conference on Information Processing*, Shenzhen, China, 2009.

[7] H. Sun, "Analysis on the problems in online shopping under prisoners dilemma," Advances in Economics, Business and Management Research, vol. 178, in *Proceedings of 2021 International Conference on Enterprise Management and Economic Development* (ICEMED 2021), 2021.

[8] J. Zheng, and L. Weigang, "A game theory based model for analyzing e-marketplace competition," in *17th International Conference on Enterprise Information Systems,* Barcelona, Spain, Apr. 2015, pp. 650-657.

[9] A. O. Akingbesote, M. O. Adigun, S. S. Xulu, and E. Jembere, "Performance evaluation of cloud e-marketplaces using non preemptive queuing model," in *World Congress on Sustainable Technologies (WCST-2014)*, London, UK, 2014.

[10] M. Bichler, J. Kalagnanam, K. Katircioglu, A. King, R. D. Lawrence, H. S. Lee, G. Y. Lin, and Y. Lu, "Applications of flexible pricing in business-to-business electronic commerce," *IBM Systems Journal*, vol. 41, no. 2, 2002.