I.J. Information Engineering and Electronic Business, **2023, 1, 51-57**
Published Online on February 8, 2023 by MECS Press (http://www.mecs-press.org/)
DOI: 10.5815/ijieeb.2023.01.05

A Model Statistical during Covid-19 Future E-Commerce Revenue for Indonesia Aviation

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Received: 28 June, 2022; Revised: 23 July, 2022; Accepted: 19 August, 2022; Published: 08 February, 2023

Abstract: Until today, Information Technology (IT) has been felt by aviation industry showed by positive growth of operating revenue before Covid-19 pandemic. The pandemic of Covid-19 changes the world especially the aviation industry by slowing down the business transaction. This study presents statistical model on recent e-commerce revenue of aviation, the number of passengers and the IT investments then predicts future of e-commerce revenue, the number of passengers and the IT spending using Neural Networks. This method is useful to predict the future because it follows the time being. The chosen variables are intended whether IT has an impact during the pandemic for passenger generation year by year. The results show that for the next few years, the revenue, the number of passengers and the IT spending are significantly increasing, while there are problems faced in aviation industry because of Covid-19. This model also can be applied for other industry.

Index Terms: Aviation industry, Covid-19, Future prediction, Neural network, Statistical model

1. Introduction

Information Technology (IT) fasten the business process of the industry. IT can obtain faster communication among stakeholders, ease transaction, process larger data, automate the process, handle e-commerce, and so on [1-3]. The advantages of IT can be enabled by the industry investing more money on IT [4,5]. IT intensive goods and services production integrate the services and products that depend majorly on IT for provisions e.g. complex engineering designing or accounting services and the manufacturing of goods that are tangible with which manufacturing IT is fundamental e.g. precision machining, which utilizes computing numerical controls and chemical process plant, which is governed by computers.

The aviation industry felt the advantages of IT long time ago. We, the authors, believe that the advancement of IT may contribute everything for the aviation industry. The use of IT for aviation industry is to generate more customer/passenger to use the service of the aviation industry [3], [6-9]. The passengers may use the application to gain better experience, faster service and reliable flight [3,10,11]. The defined benefit will push the aviation industry to invest more money. Table 1 shows the income of the largest aviation company in Indonesia based on top safety in 2020 [12].

Since Covid-19, E-commerce points to all of commercial transaction that related to organization and individual that based on digital system such as internet. In Indonesia e-commerce as a one of activity in economics pattern that supported by internet infrastructure has a wide segmentation and implementation. Outlined by Indonesia Ministry of Communication and Information Technology, activity of e-commerce will be maximize implemented in Indonesia when supported by the infrastructure, connectivity, tendency of changing in people behavior and the ease of using e-commerce facilitated by enterprise.

Table 1. E-Commerce Income Total for the Largest Aviation Company in Indonesia (Garuda Indonesia Annual Report 2013-2018)

Year	E-Commerce Revenue - ER ($ Million)	Total Revenue - TR ($ Million)	ER / TR (%)
2013	400	3,760	10.63
2014	470	3,930	11.95
2015	580	3,810	15.22
2016	590	3,860	15.28
2017	620	4,170	14.86
2018	700	4,330	16.16

Table 1 is the operating revenue of the company during 2013 – 2018. The table shows that the operating revenue always positively grew up. At the end of 2019, the pandemic of Covid-19 hit the world. Every nation struggles and locks some areas down. USA, China, Italy, South Korean, Singapore and even Indonesia are the nations locking some areas down [13,14]. Locking down creates low national demand but high cost for the industry without revenue generation [15]. As the results, it can create new unemployment because of the pandemic [16], especially aviation industry [17]. To understand this situation, there is a need of research for forecasting the nearest future revenue of the industries statistically. This study will focus on the understanding and well accept the future revenue growth of aviation in the pandemic of Covid-19 situation. In fact, the Covid-19 has broad impact to promote digital system in the several aspects such E-commerce. This situation is not only impacting their current business performance but also threaten their business survivability and sustainability.

This paper contains several sections. The next section is the review of literature and research methodology. The following section explains the analysis and discusses about the findings. The last section concludes the findings and adds future research.

2. Literature Review

2.1. Aviation Industry

Aviation industry is an industry operating many complex operations, such as airport [3,9], ground operation [18], airlines [3,9], cargo [18], seat class [18], etc. Airline company operates aircraft to have passengers to generate income. The company also has to analyze the profitability through fuel costs, route distance, time-based costs, lost income and overflight costs [17,18].

The aviation sector can be said as pioneer for the following sector. The industries may appear, such as: (1) travel, (2) tourism, and (3) cargo because of easy transportation [3,9]. The travel and tourism industries appeared because of human needs for movement between 2 places [3,9,17]. Meanwhile, cargo appeared in order to distribute things [9].

As today situation of Covid-19, the crisis generates many healthcare issues [15,17]. In airline, the absence of flying can create unknown situation called “out of currency” or “not current” [17]. So, it needs high level of regulation for commercial air transportation [17].

In accordance with the provisions of the Government of Indonesia, during the Covid-2019 pandemic the airline required every domestic flight passenger to complete the required document for a COVID19 Free Health Certificate in the form of: 1) Polymerase Chain Reaction (PCR) Test results are negative, or 2) Rapid results are non-reactive with a validity period of both of them a maximum of 14 days from the time issued by the health facility (Informatika, 2020). Developed a choice model using six alternative forms of safety information presentation to examine how travelers respond to different levels of safety risk in making flight decisions. The results showed that safety information presentation influenced tourists’ decision rules and willing to pay (Koo et al., 2018). This study aims to examine factors affecting willingness to pay for LCC airline safety domestic flights during the Covid-19.

2.2 Information Technology for Airline

To organize the profitability, IT and Information Systems (IS) need to be well developed by the company [9]. The IS solutions are airline management, airline operations, passenger airline and supplementary airline [9,11]. In addition, the design framework of an aircraft advances many aspects on (1) integrated products, (2) services, processes and interactions and (3) systems and organizations [10].

Not only those mentioned benefits of IS, but also large datasets can be analyzed using Big Data for airline route profitability [18]. Airline route profitability is analyzed through routes, shifting passengers, freights, speeds, total distance and amount of departure fuel, and so on [18]. By applying this IS (Big Data level), a company can generate the optimal profitability [18].

The airlines organize the various operating systems to achieve the transport value of the airlines around the matching of these three core resources. Flight resources are to get approval through application according to market development, including flight numbers of timing, aircraft model and other related elements. The aircraft resources are the aircrafts that are provided by maintenance system and they conform to the airworthiness operation and meet the flight operation demands and service standards. The crew resources are the human resources who are qualified for

aircraft and flight operation and occupied in the flight, such as the flight attendant crew and the flight crew. The formation process of capacity is the process of matching the three core resources of the airlines and guaranteeing their effective operation.

3. Research Method

3.1 Dataset Processing by Neural Network

Figure 1 explains data retrieval process and the analysis process. This study will employ the total of IT investment, e-commerce passenger and e-commerce revenue at the end of the year. All the data are retrieved between 2013–2018. After that, the analysis process employs the time series of neural network. IT invests, e-commerce passenger and e-commerce revenue are collected from annual report. The collected datasets are then analyzed by neural network. After that, we report the finding.

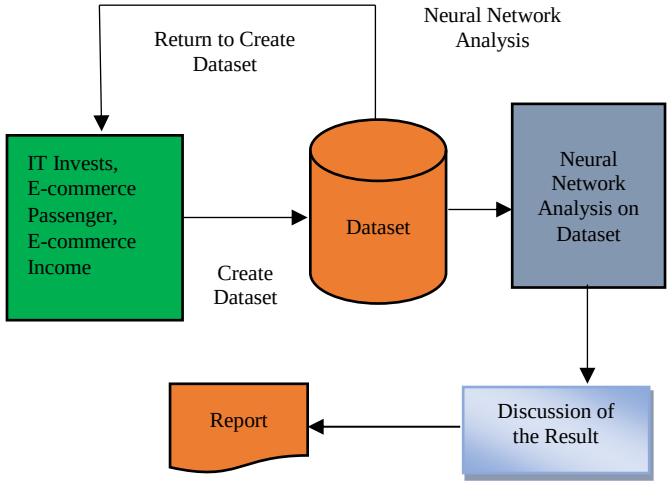

Fig. 1. Dataset Processing Neural Network

3.2 Dataset for Study

Table 1 is our first dataset for this study. The other one is e-commerce passenger and e-commerce revenue. Table 2 exhibits the total of e-commerce passenger at the end of the year. Meanwhile, Table 3 exhibits the total of IT spending at the end of the year.

Table 2. E-Commerce Passenger for the Largest Aviation Company in Indonesia (Garuda Indonesia Annual Report 2013-2018)

Year	E-Commerce Passenger - EP (Million)	Total Passenger - TP (Million)	EP / TP (%)
2013	4.13	19.56	21.11
2014	2.35	21.38	10.99
2015	13.76	23.58	58.35
2016	7.15	23.92	29.89
2017	8.23	23.96	34.35
2018	9.09	23.61	38.50

Table 3. Total of IT Investment for the Largest Aviation Company in Indonesia (Garuda Indonesia Annual Report 2013-2018)

Year	IT invest ($ Million)
2013	4.85
2014	5.78
2015	7.12
2016	11.74
2017	6.35
2018	10.7

3.3 Time Series of Neural Network Forecasting

Time series is a vector required time t. this method will predict the future data based on available data [19]. The length of historical data is important for this method to calculate longer future data where s is the horizon of prediction [19]. The formula is:

$$\hat{X}\ [\ t + s] = f\ (\ x(t), x\ (t\text{-}1) \ldots\ x(t_{i+1})\ )\ \ (1)$$

Formula (1) can be depicted:

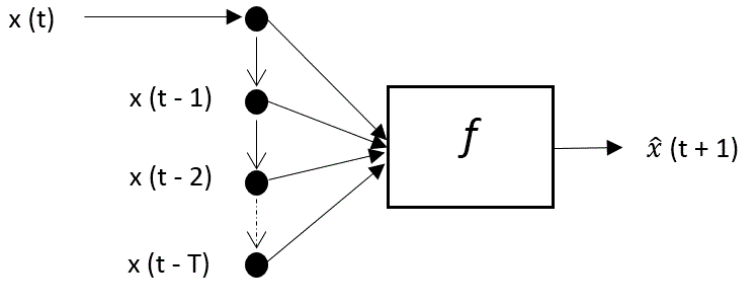

Fig. 2. Time Series Processing Neural Network [20]

This study utilizes autoregressive model [21]. The model assumes that the center from Infinite Impulse Response should be filtered and applied by internal signal $\in [t]$. The formula can be written below [22]:

$$x[t] = \sum_{i=1}^{p} \propto_i x\ [\ t - 1] + \in[t] \quad (2)$$

Equation (2) is simple, but some researches explains high complexity [23]. If, the average of $\in$[t] is lower than x[t], then x[t] will follow Equation (3) and (4):

$$\hat{x} = x[t] - \in[t] \quad (3)$$

$$= \sum_{i=1}^{p} w_i\ x\ [\ t - i\ ] \quad (4)$$

4. Analysis Results

4.1 Analysis Result of IT Investment

Equation (1) to (4) is performed to analyze table 3. The result is shown in table 4.

Table 4. Future Trend of IT Investment for the Largest Aviation Industry

Year	IT invest ($ Million)
2016	11.74
2017	6.35
2018	10.7
2019	12.62
2020	17.95
2021	14.32
2022	37.44

Table 4 is the future trend of IT spending between 2019 – 2022. Even though, the trend is positive, some years show the opposite. The downtrend is happened in 2021. However, in 2022, it gains positive trend. Overall, the result shows that a positive growth is happening from 2016 – 2022.

4.2 Analysis Result of E-Commerce Passenger

Equation (1) to (4) is performed to analyze table 2. The result is presented in table 5.

Table 5. Future Trend of E-Commerce Passenger for the Largest Aviation Industry

Year	E-Commerce Passenger (Million)
2016	7.15
2017	8.23
2018	9.09
2019	10.31
2020	9.70
2021	11.23
2022	12.21

Table 5 presents the analysis result of e-commerce passenger. The uptrend is shown between 2016 – 2022. The result also indicates the declining trend in 2020. After 2020, the significant uptrend occurs.

4.3 Analysis Result of E-Commerce Revenue

Equation (1) to (4) is performed to analyze table 1. The result is presented in table 6.

Table 6. Future Trend of E-Commerce Income for the Largest Aviation Industry

Year	E-Commerce Revenue (Million)
2016	590
2017	620
2018	700
2019	743.93
2020	934.61
2021	769.26
2022	1,188.32

Table 6 is the analysis result of future e-commerce income. The result indicates positive trend between 2016 – 2022. Though, the trend is uptrend, but, the declining trend can be seen in 2021. The next year, the uprising trend will happen.

5. Result and Discussion

Forecasting analysis is lately predicted the future result of some industries. In telecommunication industry, the forecasting is able to predict the relationship between Base Transceiver Station (BTS) and revenue growth [24]. Analysis on radiation utilized neural network to predict 7 years ahead [22]. Deep increasing-decreasing linear on financial prediction also was studied [19]. Forecast of pore-water pressure was also researched [25]. Virtual Machine (VM) prediction on migration had been done [26]. The newer result on future forecast of banking industry gave the same result [27] and also the result on security prediction [28]. For that reasons, we then do discussion. The discussion will follow table 7.

Table 7. Relational Table for 3 Variables

Year	IT Spending	E-Commerce Passenger	E-Commerce Revenue
2016	11.74	7.15	590
2017	6.35	8.23	620
2018	10.70	9.09	700
2019	12.62	10.31	743.93
2020	17.95	9.70	934.61
2021	14.32	11.23	769.26
2022	37.44	12.21	1,188.32

Table 7 explains that there is a relationship among 3 variables (IT spending, e-commerce passenger and e-commerce income). During 2016 – 2022, IT spending has risen up by 25.7 (218.91%). Meanwhile, E-Commerce passenger has grown up by 5.06 (70.77%) between 2016 – 2022. In addition, e-commerce income shows positive trend by 598.32 (101.41%). Table 7 also shows otherwise. Even though, IT investment is declining in 2021, the e-commerce passenger is rising up and e-commerce revenue is going down. Besides that, the increasing IT investment in 2020 brings the declining e-commerce passenger but the uprising e-commerce revenue.

Some studies defined that IT can bring better revenue for aviation and tourism industries. The research of IT in aviation stated that higher number of passengers will impact and move the conventional airport into e-airport or even intelligent airport [3]. The modernization of aviation through IT application (website) also opens new routes (local and international routes) and extends the airplane capacity [3]. The IT impact, the focus on passenger and the growing competition require better business process, faster response on passengers, faster business decision, then it will impact on profitability [3,9]. From the study of the past research, it can be concluded that this study extends the state-of-the-art for the impact of IT on revenue generation through having passengers in the situation of Covid-19 pandemic. As the world faces the pandemic of Covid-19, the pandemic hits aviation industry not so bad. It can be seen that there is positive growing in 2022.

6. Conclusions and Future Works

This study has shown that the positive growth will occur for the following year of the aviation industry. We found that though the pandemic of Covid-19 hits the aviation industry between 2020 and 2021, it grows up in 2022. The discussion on Table 7 makes it clear on future revenue of the largest company in Indonesian aviation industry.

In this study, there are several limitations. First, this study only discusses 1 variable (e-commerce revenue). Second, the length of datasets is from 2013 - 2018. Third, this study only uses time series of neural network. Fourth, the comparison of other country also can be done. Fifth, the analysis of IT value for aviation may be done based on previous studies [2,29-34]. Hence, the future works can be done for the proposed limitation.

Acknowledgment

We thank the Department of Computer Engineering, Universitas Wiralodra and the Department of Software Service, Platinumetrix Pte. Ltd as the support on our research.

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How to cite this paper: Taufik Hidayat, Rahutomo Mahardiko, Ali Miftakhu Rosyad, "A Model Statistical during Covid-19 Future E-Commerce Revenue for Indonesia Aviation", International Journal of Information Engineering and Electronic Business(IJIEEB), Vol.15, No.1, pp. 51-57, 2023. DOI:10.5815/ijieeb.2023.01.05