Biometric Technology Application in the Aviation Industry: Preliminary Findings from Passenger Perspective

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Abstract: The global aviation industry is growing, with the current global airline revenues already exceed £600 billion per annum (IATA). Despite the importance of the technology application in the aviation sector, not many studies are looking at the perception of technology adoption at the airport from the passenger point of view. This study provides the landscape of biometric technology usage in the aviation industry. Quantitative study is adopted in this study to achieve the research objectives. The potential of technology advancement in aviation sector will also be discussed.

Keywords: Aviation, Biometric, Technology, Passenger

1. Introduction

There are various drivers that leads to the success of any organization such as environmental factor, political, economy, society, technology (Rahman & Ahmad, 2020) top management team networking and diversity (Salleh, Fareed, Yusoff & Saad, 2018; Salleh, Fareed, Yusoff & Saad, 2016) and employees' contributions (Raza, Noor, & Fareed, 2020) structure and systems of the organization (Fareed, Isa, Ahmad, & Laeeq, 2016) competent and capable HR (Fareed, Isa, Noor, 2016; Fareed, Noor, Isa, Shahzad, & Laeeq, 2016). But among all above mentioned driving forces, the new wave of technology in this era has transform many business activities to be more solid, fast, reliable and efficient. Technology adoption in transportation sector had been introduced with the early development of computers as it helps the documentation. Besides it, it also helps the operational activities recorded systematically (Rahman et al, 2019). After almost three decades of technology evolvement from the invention of computers, internets, communication devices and system, tracking and tracing, the widespread of the availability of huge data is also introduced as a result from rapid technological developments (Sivarajah; Mahroof, 2019; Kumar et al 1999). For instance, in the logistics and transportation field, technology was used to its performance especially for data storing, monitoring the movement if the product at the warehouse, tracking and traceability of the freight and many more (Rahman et al 2018, Khairuddin et al 2018). The technology adoption in organization is not only beneficial to the business players, but also to their customer. In term of supply chain activity also, the monitoring of the product movement can be seen into this mobile devices and improved customer satisfaction as the customer can get up to date information about the movement of their product any time and at any place (Speranza, 2018). Technology is acknowledged as a key vehicle for business success and sustainability.

The use of technology is vital in every industry including aviation. The future of air transport industry or aviation sector are highly dependent on its technology application. This is not only mean to the airlines operator, but also other aviation players such as airport operator, cargo provider, in flight caterer, aviation manufacturing, the ground handler, the MROs (maintenance, repair and overhaul) as well as general aviation organization. Recently, the International Air Transport Association (IATA) has highlighted the key trends of technologies used in the aviation sector. IATA has identified a number of technologies that is important for the development and sustainability of the aviation sector. Among the technology discussed including cybersecurity, additive manufacturing, 3D printing, big data, cybersecurity, virtual reality, augmented reality, biometric technology and many more.

Current technologies such as self-service check-in kiosks, kiosk baggage tags, mobile airport apps and self-boarding gates are now integral to modern air travel (Lee et al., 2012). All of these innovations play an important role. While current technology is well-established, it is not necessarily interoperable, reducing the efficiency of passengers moving effectively and efficiently through their airport journey. The introduction of new technologies is a priority for airports across the country, with different results being achieved with each implementation. Efficient passenger processing has proved to be often challenging with various control points and safety measures

to be implemented. The use of biometrics can be combined with the latest self-service technology to meet the challenges of ensuring safety when handling more passengers effectively and efficiently.

Biometric technology such as fingerprint verification, eyes or retina detection, face recognition has been used widely in many organizations with the aim of verification. While in the aviation sector, biometric technology was used at the airport check in, custom process, on boarding activities and in the future for baggage claim process. Having noticed this important technology application in the aviation sector.

In general, since the tragic events of 11 September 2001, the air transport industry has had a major impact. Following this case, the highest level of security measures has been introduced. Airport technologies focused on increasing security with less attention given to the effect of security updates on customer experience. This research explores a seamless airport interface thus maintaining a high level of security that is ensured by the single token ID of biometrics (Patel, 2018). The researcher also said the ability to balance the increasing security requirement with the growing demand for travel leads to problems, particularly if current processes remain in effect in the existence of additional security measures, for example facial recognition technologies. Security impacts are some of the issues involved with airports and the air transport industry globally. The current safety procedures at airports have a long history of security vulnerabilities ranging from identification, authorizing, personification, illegal ticketing, transport of illegal goods, such as drugs, weapons and explosive materials.

With these background, this study aims to explore the application of biometric technology in the aviation industry at the airport from passenger perspective. The objective of this study are twofold: this study aims to explore the awareness level of biometric technology usage at the airport and secondly, to explore the passenger perception of using biometric technology system at the airport.

2. Literature Review.

Biometric definition

Historically, the word biometrics has come from Greek, and defined bio as life and metrics meaning to measure. In other words, biometrics is the measurement and statistical analysis of the unique physical and behavioral characteristics of humans. Biometrics technology can authentication every person accurately identified by physical or behavioral traits (Boussadia, 2009; Margaret,2019). Physical biometrics are those that rely on one's physical characteristics to determine one's identity. There are examples of physical biometrics technologies such as fingerprints, finger/hand veins, hand geometry, iris recognition, retina scan, facial recognition, ear shape, voice recognition, thermography recognition, and DNA matching. Behavioral biometrics is measuring behavior such as gait, lip movement, signature recognition, and keystroke. (Miller, 2019; Liu and Silverman 2001). The combination of biometrics technology gives passengers a safer and more efficient way to authenticate during the boarding process. The figure below showed the comparison of biometrics modalities:

Biometrics	Universality	Uniqueness	Collectability	Performance	Acceptability
Face	High	Low	High	Low	High
Fingerprint	Medium	High	Medium	High	Medium
Vascular	Medium	Medium	Medium	Medium	Medium
Iris	High	High	Medium	High	Low
Voice	Medium	Low	Medium	Low	High
DNA	High	High	Low	High	Low

Figure 1: Comparison of biometrics modalities (Thakkar, 2020).

Technology application in the aviation

As explained earlier, aviation industry support many other industries such as tourism, manufacturing, business and many more. Connectivity among all this member in its supply chain is tie by technology used. The value of technology is highly emphasized in aviation industry (Rahman et al 2017). As emphasized by Ashworth and Free (2006), there are serious concern by industry including aviation players and higher education players regarding sustainability and technology implication to the society (Filho et al., 2015). Apart from biometric technology, the other technology discussed in the aviation sector particularly in the airline and airport perspective are cybersecurity, artificial intelligence, big data, block chain, automation technology and many more. See below Table 1 for technology details used in the aviation sector.

Table 1: Example of various type of technologies in aviation sector

Type of technology	Description	References
Biometric	Technology used with purpose of verification	Muller (2012)
Cybersecurity	Electronic information security system used to provide data, electronic system, server and computer from cyber attack	Haass et al (2016)
Artificial intelligence	Scaling the digital interaction between passengers and the airlines organization	Clarke and Smith 2012
Big Data	Used to predict the trends and forecast consumer behavior	Li et al 2019; Zeng and Khan (2018)
Block chain	Baggage tracking	Ning et al 2013
Automation	Auto pilot technology used in airline	Ingrand and Gallab (2017)

Source: Developed by the authors

3. Research method

To provide findings for the use of biometric technology in the aviation from the passenger perspective, this study utilized quantitative approach. A set of questionnaire using google form has been distributed via link sharing and this method lead to objective, and provide comfort to the respondents (Chambers and Skinners, 2003). The Malaysia airline industry have been chosen for this research for a number of reason, Firstly, Malaysia is known as an emerging country in Asian context and the findings could be a reference to the neighboring emerging country. In fact, there are also a dearth from past studies that looks into passenger perception towards technology adoption in the aviation industry in Malaysia (Rahman et al., 2020; 2017). According to Sukati et al (2015), safety are the main criteria for travelers or airlines passengers in choosing the airlines to travel. Additionally, Amiruddin (2013) emphasis on the technology use could avoid negative feeling to the passengers and feel more safe and secure to travel.

This survey method researcher using Google Form as the platform to generate questionnaire. The questionnaire consists open-ended question and also close-ended questions. The first section is a multiple-choice answer on demographic information that will be chosen based on the preferences of the respondents. Next, the second section will include multiple choices, checkboxes and linear scale rates for respondents. The questionnaire uses 5 Likert scale ranging from strongly agree, 5 means that it is strongly agree, 4 means agree, 3 means average, 2 means disagree, 1 means strongly disagree and 0 is not an idea. These questions are based on the evaluation of biometric technology at the airport. The third section deals with the impacts of biometric technology at the airport, which the respondent will choose to respond to using a multi-choice response style. Those three sections above require respondents to provide opinions, ideas, comments or choose the answer based on the options provided in the same questionnaire. Lastly, the forth section is an open-ended question which the respondents to give opinions, ideas, suggestions or comments regarding implementation of biometric technology around airports in Malaysia.

The questionnaire survey was distributed to random respondents by sharing the link of survey through broadcast list phone contacts and posting the link at social media platform such as Instagram and Facebook. There were 137 responses received from this.

4. Research Findings

Details of *respondent* profile

In this section, we will briefly explain on the respondents details specifically on the respondent's nationality, gender, age as well as profession. The total of respondents or passengers involved in this study are 137. From the total respondents, 97.1% of the respondents are Malaysian nationality, while the remaining 2.99% is non Malaysian passengers. Additionally, 48% of respondents are female, while the other 52% is male respondents. The majority of the passengers involved in this study is between 21 to 30 years old and are employed. See Figure 2 below for details.
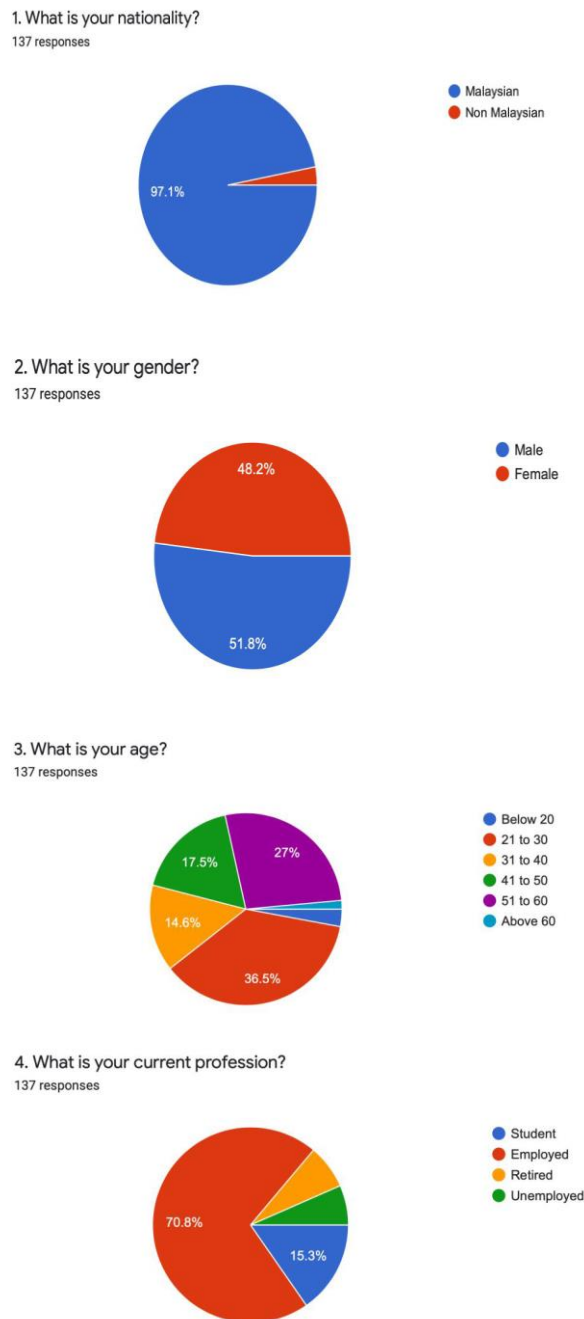
Figure 2: Demographic information of the respondents involved in this study

Passengers Perception of Biometric technology usage at the airport.

The findings show the majority of the respondents are aware about the existing of biometric technology. From the findings, it shows that 61.3% of the respondent heard the biometric technology that equal to 84 respondents. Meanwhile, 19.7% responded maybe which they not sure about biometric technology where represent 27 respondents. The minority of respondents respond that no heard about biometric technology with 19% respondents which represent 26 respondents. The reason why the respondents respond maybe is because they were actually confusing with the biometric technology word. In reality, almost we were living in biometric technology such as smartphone, withdrawal money and so on. Almost of these activities involving biometric technology such as fingerprint recognition we used to verify our identification. This result is shown in below figure 3.

Have you ever heard before about biometric technology?
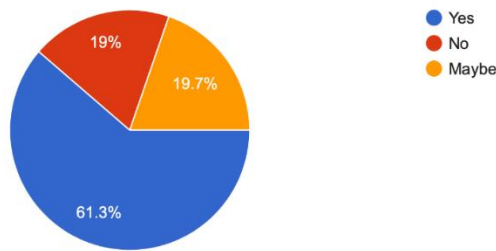137 responses

Figure 3: Respondents' awareness of biometrics technology

Respondents Knowledge On Biometric Technology

The data below shows the number of respondents' knowledge on biometric technology. Based on the pie chart above, there were 30.7% responds that knowledge on biometric technology were important (4) which represents 42 respondents be the majority of this survey. Meanwhile, the second highest were average (3) shown 27% which 37 respondents participate. The third highest of the result was 16.8% respondents felt the knowledge about biometric technology were not important (2) which represent 23 respondents. Next, 14.6% felt very important (5) about the knowledge of biometric technology which were representing 20 respondents. There were 8% respondents felt very not important (1) which equal to 11 respondents. Lastly, the minority respondents of this question were 2.9% felt not an idea (0) that shown only 4 respondents.

How would you rate your knowledge about biometric technology?
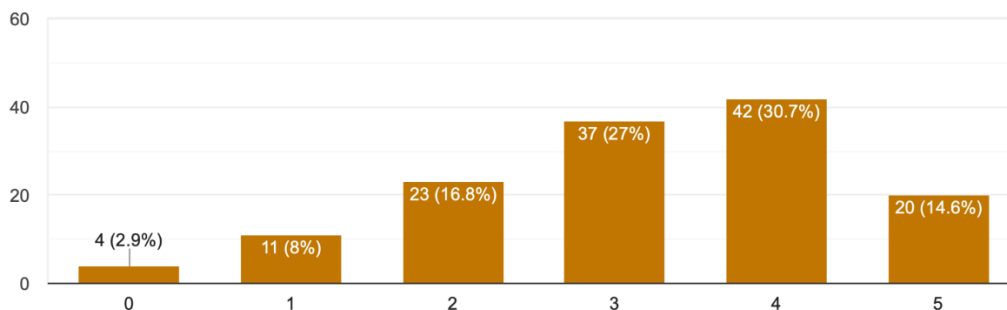137 responses

Figure 4: Rate of respondents' knowledge on biometrics technology

Respondents Experience Using Biometric Technology

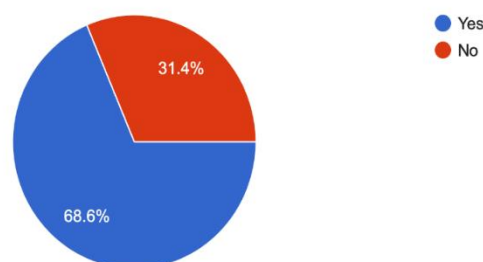Have you ever tried a biometric technology?
137 responses

Figure 5: Respondents' experience using biometric technology

From the questionnaire findings, it shows that 68.8% (94 out of 137) respondents have experience in using that technology while the remaining 31.4% (43 out of 137) respondents were responds no ever tried biometric technology. The researcher found that who responds no were actually not understand and confuse on what question asked. Therefore, the next question was established to cross check and confirm whether the respondents have experience in using biometric technology before.

Respondents Preference of Biometric Technology

What kind of biometric technology you ever tried?
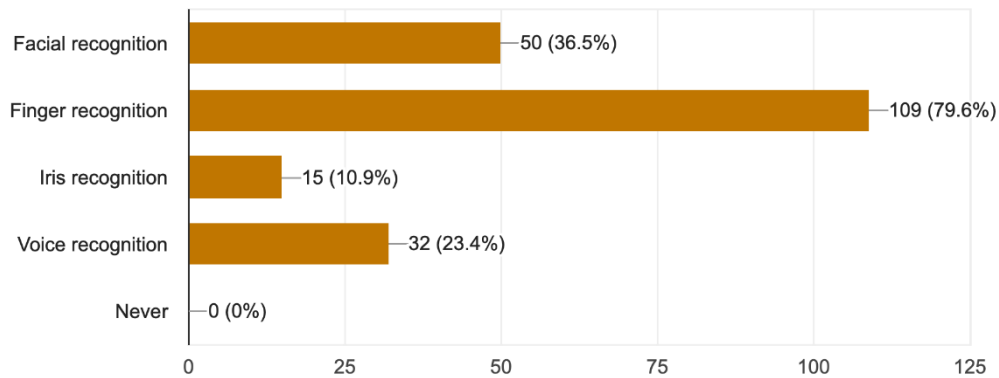
137 responses

Figure 6: Respondents preference of biometrics technology

The above figure 6 shown the numbers of respondent's preference of biometric technology. The majority 79.6% (109 out of 137) respondents were tried finger recognition. Next, facial recognition be second highest of biometric technology tried by respondents which 36.5% (50 out of 137). The third highest was voice recognition which 23.4% (32 out of 137) respondents. For the fourth highest was iris recognition which 10.9% (15 out of 137) respondents. Lastly, there was 0% (0 out of 137) respondents never tried biometric technology.

From these findings, we can conclude that majority respondents or passengers have a good awareness about biometric technology. Findings shows that majority of the passengers are familiar most with finger recognition. In general, everybody are experienced with finger recognition when we apply our identification card (IC) or applying a passport before we went travel cross other country. From this study, facial recognition be the second highest responds by respondents participate. The researcher felt might be not everyone have a smartphone which completely with facial recognition to generate a password using our face. Then, voice recognition be the third highest answered by respondents. This technology not everyone interested to use because of our habitual more using finger than our voice. Lastly, the minority of respondents were iris recognition. These because iris recognition was rarely found and have limitation to use in public.

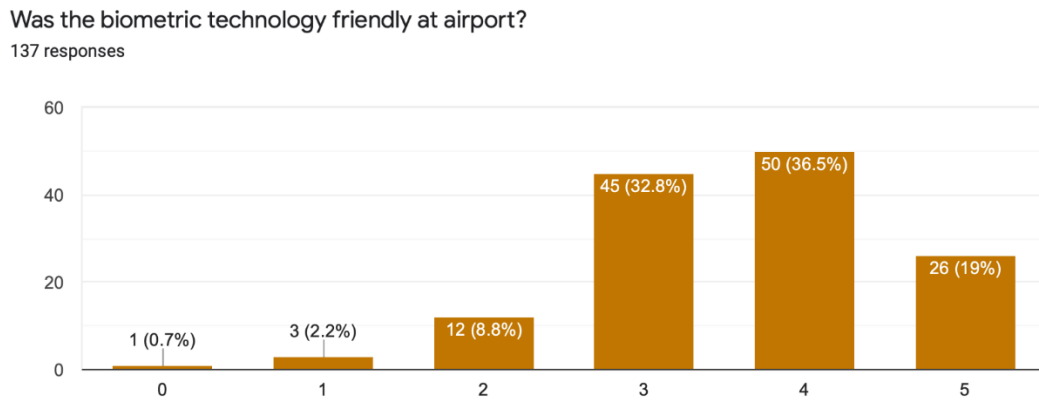**Perception of Biometric Technology At Airport**

Figure 7: Passengers' perception of biometrics technology at airport

The bar chart illustrated in Figure 7 above shown the perception of respondents into biometric at airport. Based on the bar chart above, the majority answered were agree (4) the biometric technology friendly at airport which 36.5% (50 out of 137) respondents. Next, the second highest respondents were average (3) which equal to 32.8% (45 out of 137) respondents. The third highest was strongly agree (5) were 19% (26 out of 137) respondents. The fourth highest was disagree (2) which shown 8.8% (12 out of 137) respondents. Then, the strongly disagree (1) was be the fifth highest of respondents which 2.2% (3 out of 137) respondents. Lastly, only 0.7% (1 out of 137) was no idea (0) on this survey.

Based on the data above, the researcher found the majority of respondents were agree with the biometric technology friendly at the airport. Nowadays, there were many airports implementing biometric technology to improve the airport user experiences. Therefore, these was a prove which biometric technology friendly at airport.

Passengers Perception of Biometric Technology During Boarding
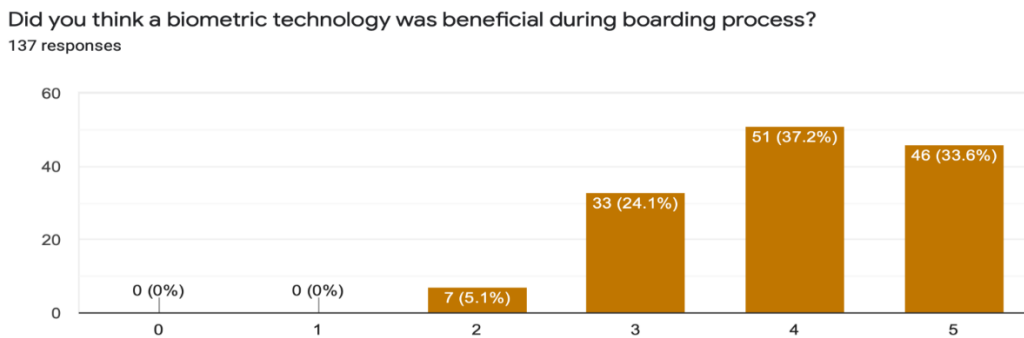

Figure 8: Respondents' perception of biometrics technology during boarding

The bar chart in Figure 8 above shown the number perception of respondents into biometric technology during boarding. There were majority respondents agree (4) on the biometric technology was beneficial during boarding process which 37.2% (51 out of 137) respondents. The second highest were 33.6% (46 out of 137) respondents which strongly agree (5) on the biometric technology was beneficial during boarding process. Next, the third highest was 24.1% (33 out of 137) respondents were answered average (3) on this survey. Lastly, the minority was responded disagree (2) which 5.1% (7 out of 137) respondents.

Based on the data above, the researcher found majority of respondents were agree on the biometric technology was beneficial during boarding process. As we known, this biometric technology could enhance and improve the existing technology at the airport. Therefore, these the prove respondents agree on biometric technology was beneficial during boarding process.

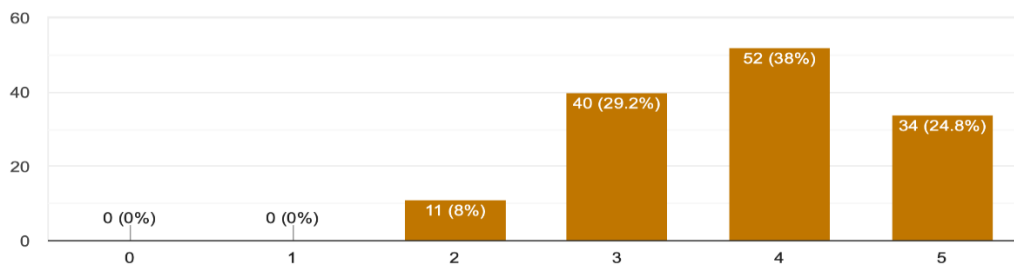**Biometric Technology Vs. Current Technology at the Airport**

Figure 9: Biometrics technology vs. Current technology at airport

The bar chart above shown the comparison of efficiency between biometric technology and current technology at airport. There were 52 out of 137 respondents of 38% agree (4) that biometric technology more efficient than current technology at airport. Next, the second highest of respondents were responds average (3) which 40 out of 177 respondents that equal to 29.9%. Meanwhile, there were 34 out of 137 respondents of 24.8% strongly agree (5) that biometric technology more efficient than existed technology at airport. Lastly, the minority was 11 out of 137 respondents of 8% that disagree (2) which biometric technology more efficient than current technology at airport.

Based on the above findings, the researcher found majority of respondents were agree which the biometric more efficient than current technology at airport. Currently, a lot of airports upgrade the technology they used to biometric technology for more seamless and efficient the movement of passengers in airport.

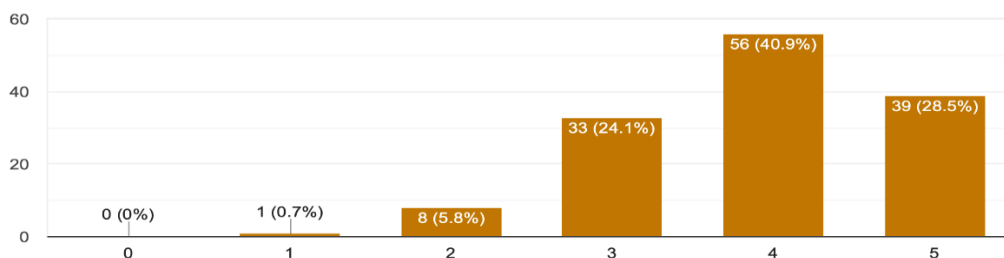**Security Level of Biometric Technology At Airport**

Figure 10: Security level of biometrics technology at airport

The bar chart above shown the security level of biometric technology at airport. Based on bar chart above, majority respondents agree (4) that biometric technology more secure than current technology at the airport which 40.9% (56 out of 137) respondents. The second highest responds were strongly agree (5) that biometric technology more effective of security level compare with current technology at airport. Next, the third highest were answered average (3) which shown 24.1% (33 out of 137) respondents. However, there were 5.8% (8 out of 137) respondents disagree (2) that biometric technology not secure than current technology. Lastly, only 0.7% (1 out of 137) respondents strongly disagree on biometric technology more secure than existing technology at airport.

Based on data above, the researcher found majority of respondents were agree that security level of biometric technology more secure than current technology that have at airport. These shown security level can be enhance and more safety which any fraud identification can be avoided for safety flight operation. Therefore, the researcher can prove biometric technology was more secure through this survey.

The Impacts of Biometric Technology Usage at The Airport

What do you think about the impacts of implementation of biometric technology towards boarding process at airport?
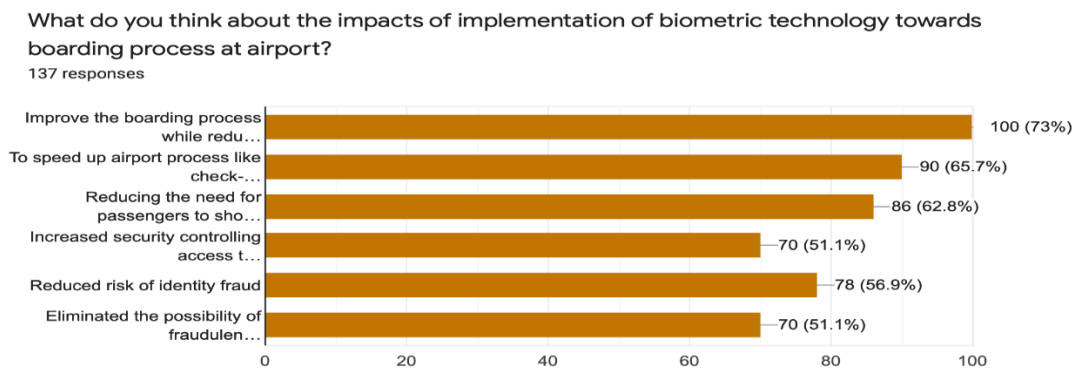137 responses

Figure 11: The impacts of biometrics technology at airport

The bar chart in Figure 11 above shown the number of respondents on the impacts of biometric technology at airport. Based on bar chart above, there were 100 out of 137 respondents of 73% said that the biometric technology can improve the boarding process the amount of time it takes to board an aircraft. Next, there were 90 out of 137 respondents of 65.7% answered that biometric technology can speed up airport process like check-in, baggage drops and boarding process. Then, the third impact of biometric technology at airport was reducing the need for passengers to show or scan their travel documents which 86 out of 137 respondents of 62.8% choose as one of the impacts. The forth impacts were reduced risk of identity fraud which responds by 78 out of 137 respondents that equal to 56.9%. Lastly, remaining impacts share same results which 70 out of 137 respondents of 51.1% responds the impacts of biometric technology at airport were increased security controlling access to the restricted zone at the airport and also eliminated the possibility of fraudulent use of lost or stolen ID cards.

Based on data above, the researcher found majority 137 out of 137 respondents of 100% responds that biometric technology gives huge impacts at airport on the effectiveness and efficiency of airport operations. The biometric technology can enhance the passenger's movement be seamless and also avoided any criminal activities such as fraud identity and intention hijack the aircraft.

5. Conclusion

In this paper, we have explored the usage of biometric technology in the aviation sector from the passenger viewpoint. Findings shows significant awareness of the technology among the passengers. Research on biometric technology especially on each specific identity management system such as face recognition, finger recognition and other features could be further explored on its efficiency by future scholars.

6. Acknowledgement

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24. The researcher recommends that this research continue to explore the benefits of biometric technology during the boarding process at airports around Malaysia. This is because the biometric technology will help airport operators and airlines to improve the performance of airports and airlines. Furthermore, an improved information sharing platform for safety contributes to awareness-raising among air operators and aviation industry players alike. It will help all parties to learn from the lessons learned from any event captured. This is because, time after time, aviation safety performance needs to be maintained and developed in order to ensure the safety of the aviation industry. In addition, the experiences of passengers can be enhanced which the biometric technology can be combined with these current to help meet the challenges of maintaining security while processing an increasing number of passengers efficiently and quickly