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# Analyzing the Influence of Internet of Things (IoT) Data Mining in Medical Tourism Industry

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**Abstract.** The striking around the world transmission of COVID-19 has empowered numerous governments to meddle to maintain a strategic distance from the spread of the contamination. Medical tourism could be a developing marvel with arrangement suggestions for wellbeing frameworks, especially of goal nations. Medical tourism, a quickly developing adverse, has been recognized by numerous nations as a potential segment for financial diversification. In spite of the fact that Malaysia stands out as one of the best goals of therapeutic tourism, examination with respect to its competitiveness has been constrained and contract in scope. An increasing number of tourist destinations and hotels are using new technology and solutions to promote their products and services. IoT represents a great opportunity for tourism and hospitality to increase customer satisfaction while simultaneously reducing operational costs. This case ponder takes a quantitative approach to distinguish and analyze the IoT time-series data variables that position Malaysia as a competitive medical tourism goal. Based on an all-encompassing approach, this ponder has appeared that coordination of differing procedures for restorative tourism improvement with sound government arrangements and proactive administration hones has driven to significant positive results towards the shared victory of tourism and healthcare segments of Malaysia.

**Keywords.** Internet of Things IoT, Tourism performance, medical tourism, service sector, exchange rate, Malaysia.

## INTRODUCTION

To create the Web of Things more intelligent, numerous analytics advances have been presented, one of the foremost profitable of which is information mining. They will be pivotal in wellbeing, therapeutic tourism, security, and security applications, as well as social life applications. Information mining is the method of identifying novel, curiously, and possibly valuable designs in huge information sets and after that applying calculations to extricate covered up data. Information mining is getting to be more prevalent, in the event that not more imperative, within the field of healthcare. Each day, different healthcare associations produce heterogeneous therapeutic information, such as payers, sedate suppliers, sedate data, medicine data, therapeutic notes, or clinical records. This quantitative information can be utilized to move forward care and decrease squander by performing clinical content mining, prescient demonstrating, survival investigation, persistent similitude investigation, and clustering. Affiliation investigation, clustering, and exception examination can all be utilized within the restorative field. Information from treatment records can be extricated to examine ways to decrease costs and give way better solutions. Information mining can too be utilized to recognize and get it high-cost patients, as well as to recognize unusual designs and distinguish extortion in expansive sums of information produced by millions of medicines, surgeries, and treatment forms. Intense wellbeing and wellness sharpness are imperative components that draw healthcare users'

consideration to IoT gadgets. It evacuates the fear of visit healing centre visits and expensive specialists. Consumers of health products in the medical industry are rapidly increasing, and the advertise as an entire is being upgraded. To bargain with the developing effect of a huge number of healthcare clients, the trade demonstrate must be rearranged. Agreeing to a later study, the utilize of IoT gadgets has expanded significantly. Clients can control their wellbeing in a customized way much obliged to the Web of Things. The most prominent advantage is in information investigation and decision-making. Various investigations have uncovered that Malaysia is one of the most appealing medical tourism destinations in Asia (Yusoff, Abd Rashid, & Ibrahim, 2020). Medical tourism goal is credited to its key upper hands recalling significance for medical administrations quality, steadfastness, secure medical hones, and the availability of incalculable all around authorize globally certify healing centres. Malaysia is directly most well-known for its spa medications and outing goals. To urge a sense of what this might cruel for the economy, Thailand is well-known for therapeutic tourism, drawing in universal guests to experience surgeries in world-class offices, which come about in 3.2 billion dollars in remote exchange in 2011. Furthermore, Malaysia's authorities have assumed a functioning job in pulling in scientific travellers and buyers through advancing and helping crucial coordinated effort among a variety of companions and consenting to preparations with Middle Eastern countries for the arrangement of scientific services. It was once estimated that 350,000 Malaysians received medical treatment abroad in 2006, spending \$500 million. According to current gauges, 600,000 Malaysians travelled to distant areas for medical treatment, investing 1.4 billion dollars. Similarly, the Malaysian government, like the governments of India, Indonesia, Thailand, and the Philippines, views medical tourism as an important useful resource for monetary and social development; the revenues generated by medical tourism have a significant impact on the economies of these Asian countries. The incorporation of tourism and the fitness care industries affords the legislature a channel for broadening its economy, pulling in remote foreign exchange speculation, advancing employment creation, and strengthening the healthcare insurance plan industry (Ching Ibrahim & Rashid, 2019). The benefits of scientific tourism to destination economies' fitness care systems, in particular, have been well documented. However, some contended that clinical tourism has harmed the folks of an aim kingdom in three special ways: First, giving fitness care to scientific travellers makes health care facilities and doctors much less available to the negative in the nation. Second, this limits a government's ability to implement its own health-care policy, which may exacerbate the disparity in fitness-care access between private and public systems. Western countries likewise observe factors of interest and drawbacks from clinical tourism. Advantages from scientific tourism comprise low-cost fitness care, quicker get entry to healthcare services, and step by step customized care, accessibility of therapy, or appreciably more outstanding safety and confidentiality in the case of cosmetic surgeries. Medical tourism has regularly improved by using 2010, three many years later, the Malaysian diaspora in Indonesia had reached 385,979.19, and Indonesia has gained from Malaysian talent employed throughout a sizable array of sectors in the country. In 2017, Malaysia recorded close to 12.4 million traveller arrivals from Indonesia, making the city-state with the aid of some distance the largest source of traveller arrivals. Statistic alter, especially populace maturing and more seasoned people's needs for more logical administrations, combined with epidemiological after, i.e. holding up times or rising expenses for wellness administrations at domestic, combined with the accessibility of more cost-effective options in creating nations, has brought about in unused healthcare buyers, or logical visitors, seeking out for treatment abroad. The wellbeing segment in Southeast Asia is quickly growing, owing to the quick development of the individual segment and, in specific, restorative tourism, which is developing as a profitable commercial undertaking opportunity. Nations in this locale are capitalising on their notoriety as traveller goals by combining high-quality logical administrations at competitive costs with traveller bundles. In Indonesia, Malaysia and Thailand alone, an evaluated two million logical vacationers gone by in 2006 to 2007, livelihoods these worldwide areas over US\$ 3 billion within the clinical tourism segment. Visitors with unremitting illnesses have as of late communicated concern approximately startling crises. They may be reluctant to travel to inaccessible goals due to wellbeing issues, especially amid travel. Smartphones, sensor gadgets, cellular communications, and the Web of Things (IoT) are the foremost later advances that empower the conveyance of modern versatile location-based administrations. Such administrations can help portable sightseers, or sightseers who are right now moving between areas, in getting a set of imaginative administrations that make their travel simpler and more secure. It is basic for the wellbeing framework to create compelling arrangements to help visitors with persistent infections in finding a appropriate geographic course from the flight point to the traveller goal through the transportation organize.

## RESEARCH METHODOLOGY

The descriptive measurable examination is utilized for information investigation and communicates the amount of perception that's incompletely required to say the objective based on the data assembled. The descriptive static investigation is utilized to examine the insights of each variable included here, which are medical tourism, trade rate, benefit division development, and tourism division performance. or the IoT time-series information. The mean for each of these factors is at that point included, as is the standard deviation of the mean information. In expansion, a least and greatest amount, Kurtosis, and Skewness of the information are utilized.

**TABLE 1.** Descriptive Analysis

	Tourism Performance	Medical Tourism	Service Sector	Exchange Rate
Mean	0.060059	0.059418	0.058901	0.059245
Standard Error	0.006070	0.004621	0.000710	0.002738
Median	0.057911	0.065403	0.058803	0.054258
Standard Deviation	0.024279	0.018482	0.002841	0.010950
Sample Variance	0.000589	0.000342	0.000000	0.000120
Minimum	0.030060	0.029874	0.053208	0.047968
Maximum	0.105121	0.091339	0.062661	0.079620
Count	16	16	16	16

All of the variables in the preceding table have a range of 16 observations for Malaysia. The mean and standard deviation will be discussed first in this study. The standard deviation and mean for medical tourism are the highest. The high standard deviation esteem shows that the information focuses in this think about, medical tourism, are spread out over a more extensive run. Based on the information dispersion, the cruel for medical tourism is 0.059 and the standard deviation is 0.018. The exchange rates with the most reduced standard deviation and mean are those with a mean of 0.059 and a standard deviation of 0.011. The least standard deviation esteem demonstrates that the information focuses in this study's exchange rate are spread out over a really little run. Aside from medical tourism and the exchange rate, the other variable falls somewhere in the middle of these two. In expansion, the values for both maximum and minimum information for all factors considered in this term paper are appeared within the table over. Tourism execution is the variable with the most elevated greatest esteem. The exchange rate has the least conceivable least esteem of 0.0299. Service division with a least esteem of 0.0532 and maximum esteem of 0.0627.

**TABLE 2.** Kurtosis & Skewness

	Tourism Performance	Medical Tourism	Service Sector	Exchange Rate
Kurtosis	-0.95619	-1.07553	-0.00606	-0.95124
Skewness	0.454291	-0.17888	-0.49089	0.837577

Kurtosis and Skewness values from Table 2 were utilized to test the ordinariness of each variable utilized within the ponder. Skewness values more noteworthy than (+1) or less than (1) show a profoundly skewed dissemination, as proposed by Hair et al (2003). Moreover, Hair et al. (2005) illustrated that a bend is as well crested when the Kurtosis surpasses (+3) and is as well level when it is less than (3). Skewness inside the values extend of (1) to (+1) and Kurtosis inside the values run of (3) to (+3) show a idealize run. The values of Skewness and Kurtosis for each variable in Table 2 appear that the investigate builds were inside the perfect extend.

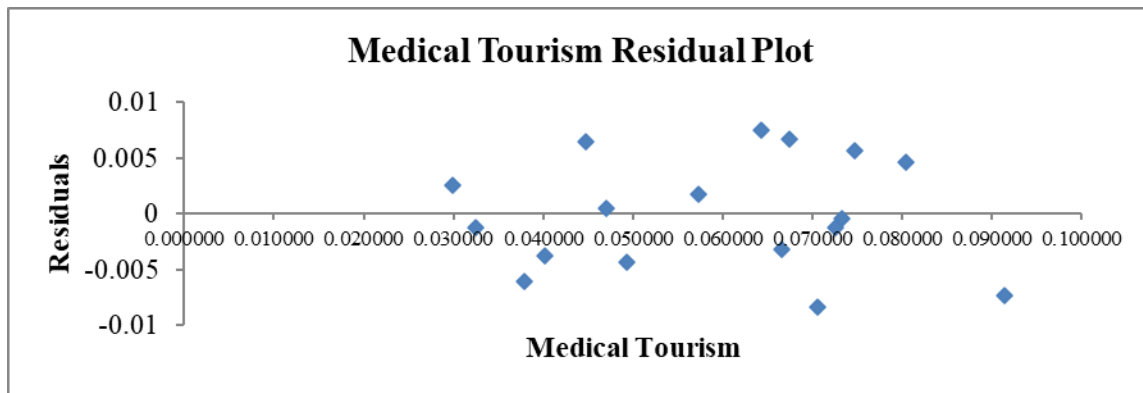
The relationship components within the association between each variable included the relationship between the subordinate variable and the autonomous variable that's being examined in this investigate consider. The relationship between medical tourism and Malaysia's tourism division performance is known as relationship.

**TABLE 3. Correlation**

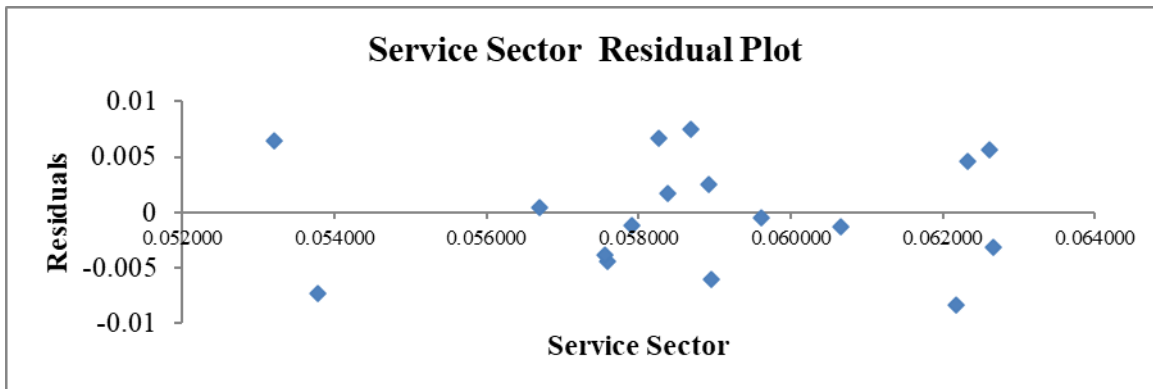
	Tourism Performance	Medical Tourism	Service Sector	Exchange Rate
Tourism Performance	1			
Medical Tourism	0.795350	1		
Service Sector	0.722554	0.287871	1	
Exchange Rate	0.885489	0.568321	0.701863	1

The relationship esteem from the extend of 0.7 to 0.9 is considered a solid relationship. The variables are service sector with tourism performance is 0.72, medical tourism with tourism performance is 0.79, the exchange rate with tourism performance is 0.88. Table 3 also shows that the correlation between the two variables in this research paper is low or poor. The weak correlation value ranges from less than 0.3. Medical tourism and the service sector have a low correlation value relationship with a value of 0.288.

The structure evident in these residual plots additionally suggests plausible issues with exclusive factors of the model. Under finest conditions, the plots in the highpoint row would no longer demonstrate any systematic shape in the residuals. Engaged at the face value, the structure considered right here shows an autocorrelation of the measurements, time vogue in the data, and the non-normal dissemination of the residuals. e that as it may, it is likely that the plots will see superior once the characteristic depicting the efficient relationship between avoidance and stack is moved forward. Troubles with one calculate of a relapse demonstrate as often as possible show themselves in more than one sort of leftover plot.



**FIGURE 1.** Medical tourism residual plot for Malaysia



**FIGURE 2.** Service sector growth residual plot for Malaysia

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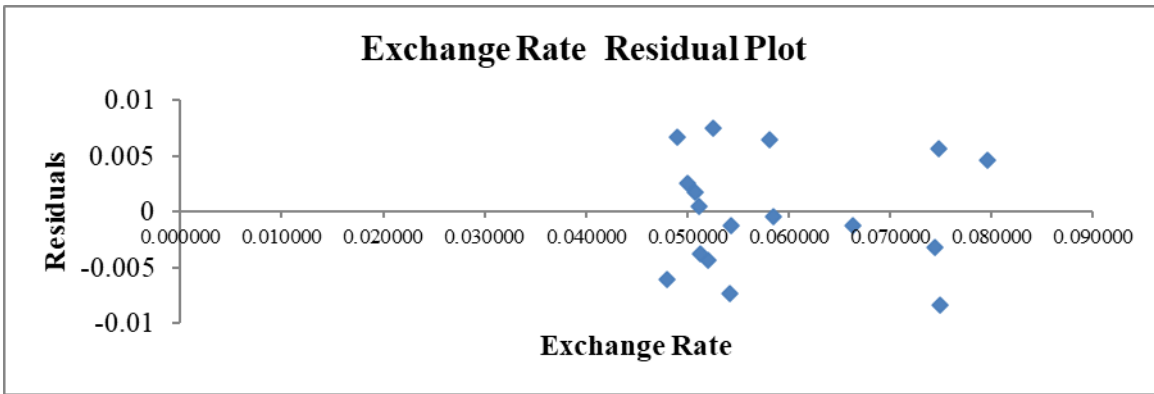


FIGURE 3. Exchange rate residual plot for Malaysia

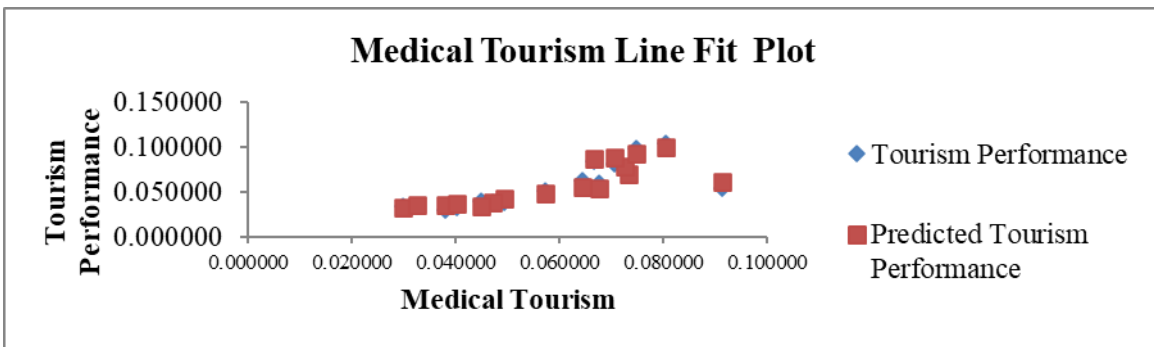


FIGURE 4. Line Fit Plot : Medical tourism

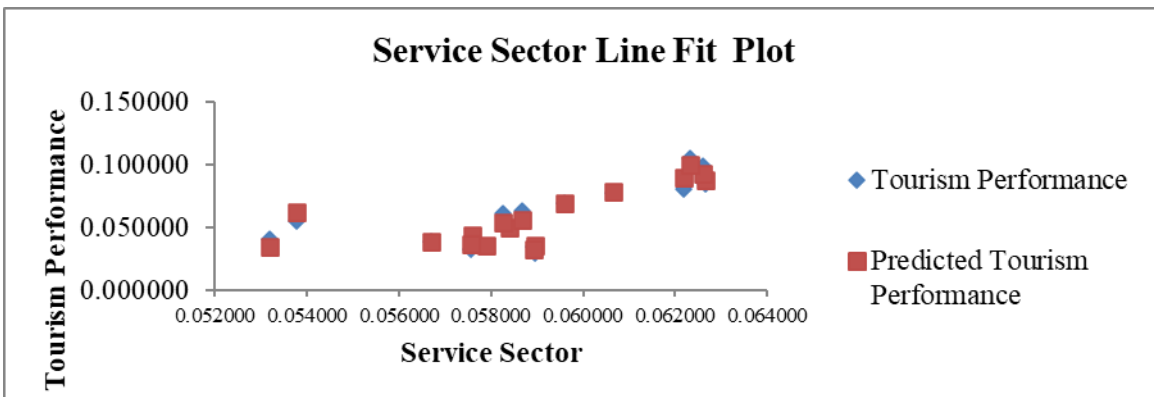


FIGURE 5. Line Fit Plot: Service sector

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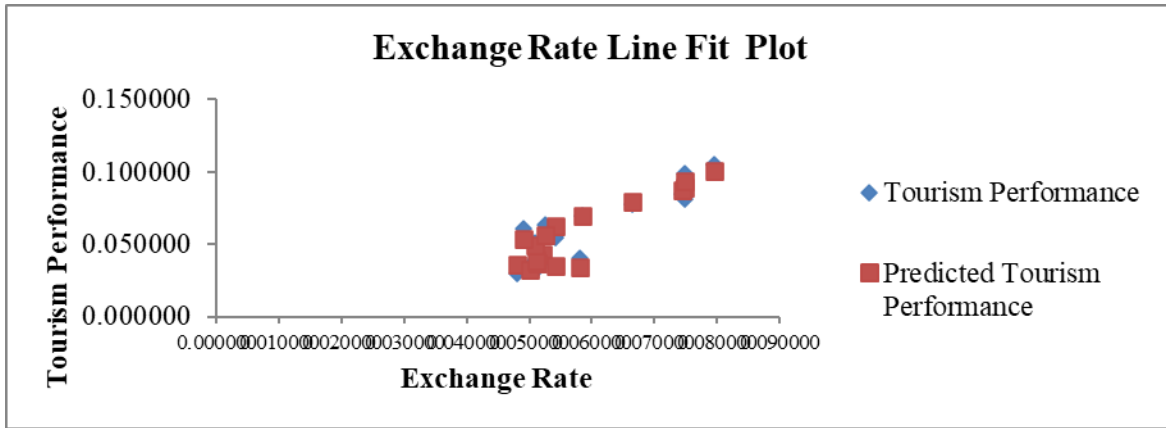


FIGURE 6. Line Fit Plot: Exchange rate

According to the Loess curve, the relationship between standardised estimated and residuals is unevenly line about nil. Since the residuals show up to be haphazardly dispersed circular zero, the comes about conclude that the relationship between the reaction variable and indicators is zero.

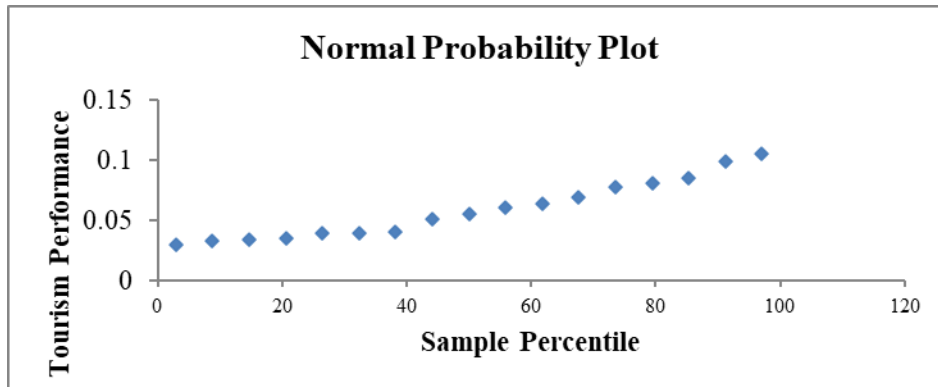


FIGURE 7. Malaysia: Normal probability plot

The reality that the angles within the plot's lower and upper abundances don't go astray essentially from the straight-line design demonstrates that there are no broadly dispersed exceptions (relative to a conventional dispersion). In this case, the comes about can decently reasonably decide that the standard dissemination give a critical show for the information. The fitted line's slant and caught give gauges for all factors prepared with a customary dissemination (Ching et al.,2019). By and large, the typical standard diffusing appears to be an worthy for these information. The probability plot, when seen outwardly, proposes a unequivocally straight design. The relationship coefficient of medical tourism, exchange rate, and supplier segment of the line coordinate with the likelihood plot affirms this.

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## REGRESSION IOT TIME SERIES DATA

**TABLE 4.** Regression: Malaysia

		<i>Regression Statistics</i>				
ANOVA		Multiple R		0.977489		
		R Square		0.955485		
		Adjusted R Square		0.945213		
		Standard Error		0.00563		
		Observations		17		
		df	SS	MS	F	Significance F
	Regression	3	0.008845	0.002948	93.01288	0.0000 (4.89E-09)
	Residual	13	0.000412	3.17E-05		
	Total	16	0.009257			
		Coefficients	Standard Error	t Stat	P-value	
	Intercept	-0.186920	0.035931	-5.20229	0.000170	
	Medical Tourism	0.641055	0.096451	6.646448	0.000000	
	Service Sector	2.645241	0.726790	3.639624	0.002996	
	Exchange Rate	0.891393	0.217999	4.088975	0.001279	

According to Table 4, the show result of R square esteem is 0.95, showing that free factors can foresee 95 percent of the subordinate variable of tourism performance. As the significant value is 0.000, it indicates that the value is significant because it is less than 0.05. As a result, the ANOVA show moreover illustrates that the value is 0.0000 esteem is factually critical. The relapse examination utilizing time arrangement information mining is to find the association between result factors and indicator. Each substance has interesting characteristics that the supposition may or may not impact. The adjusted R square is 0.95, showing that the show could be a fit demonstrate since the esteem is greater than 0.60. (Gujarati, 2004). When there's a better esteem, the superior the information fits to the perceptions. Table 4 appears that the ANOVA was utilized to legitimize the centrality of all free and subordinate factors.

### CONCLUSION

Medical tourism may be a fast-growing sector that globalization takes it easy for patient's experience in another country together for healthcare (Azman et al, 2020). Advancing IoT gadgets will hurry the reaching appropriation of the e-healthcare framework. The e-healthcare system's innovations ought to be secure, steady, viable, adaptable, power-efficient, and patient-centric. Besides, planning IoT gadgets for the up and coming e-healthcare framework is troublesome, and the victory of IoT-based e-healthcare frameworks is decided by this. Its repercussions on other businesses give a great source of income for any economy. The table above summarised the coefficient value, t-statistic value, and P-value to determine which of these variables is accepted by using regression analysis. If the value is greater than 1.96, the t-statistic is rejected; otherwise, it is accepted. The P-value will be accepted if the value is more than 0.1 and rejected if it is less than 0.1. Firstly, we start with the exchange rate. The t-statistic and P-value for the exchange rate are 4.08 and 0.00 respectively. This shows exchange rate is being accepted with a significant relationship with tourism performance at the. The next variable is medical tourism at this regression method the t-statistic value and P-value are 3.63 and 0.00 respectively shows that medical tourism is accepted in this regression and has a positive significant relationship with tourism performance. Lastly, service sector at regression method the t-statistic value and P-value are 3.63 and 0.00 respectively shows that the service sector is accepted by the regression method. Malaysia lagging late behind Malaysia and Thailand for medical patients that mostly from Asia and the Middle East. The varying background of medical travel over the years has shown remarkable challenges to Malaysia's economy (Abd Rashid et al.,2020). It is clear that novel advances are required to empower inter-communication between heterogeneous gadgets by means of the web. The arrangement of healthcare administrations and therapeutic supervision is almost to alter the whole world of imaginative advances (Samah et al, 2020).

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## REFERENCES

- Abd Rashid, Intan Maizura, et al. "Rethinking Tourism Impact and Development on Local Community in Perlis, Malaysia." *Journal of Environmental Management & Tourism* 11.8 (2020): 2043-2052.
- Azman, Mohd, et al. "Human Trafficking Policy implementation: the impact of crime rate on instability tourist arrivals in Perlis." (2020).
- Basri, Haslina Hassan, et al. "The impact of Malay transactional leadership style on employee performance; The Malaysia'pharmacy industry perspective." *International Journal of Information, Business and Management* 9.2 (2017): 45.
- Bossema, Ercolie R., Tineke HJM Meijs, and Jeroen WB Peters. "Early predictors of study success in a Dutch advanced nurse practitioner education program: A retrospective cohort study." *Nurse education today* 57 (2017): 68-73.
- Ching, Lim Leh, Suraiya Ibrahim, and Intan Maizura Abd Rashid. "An exploration of accountability practices in Non-Governmental Organisation (NGO): Malaysian perspectives." *International Journal of Business and Management* 1.2 (2019): 01-06.
- Gfrerer, Anne, et al. "Ready or Not: Managers' and Employees' Different Perceptions of Digital Readiness." *California Management Review* 63.2 (2021): 23-48.
- Husain, Wan Ahmad Fauzi Wan. "The Malay Sultanates as the Impetus for the Formation of Malaysia." *Psychology and Education Journal* 58.2 (2021): 5820-5827.
- Intan Maizura, Abd Rashid, et al. "The Initial Fiscal Policy response to Covid-19 in Malaysia through a new development model in nurturing healthcare sector: validated embedded FDI inflows–Government spending in healthcare sector framework for Malaysia." (2020).
- Khan, Snehashis. "A Qualitative Study of the Consumer Mindset that has given rise to the concept of New Tourism."
- Lee, Juil, et al. "Enhancing employee creativity for a sustainable competitive advantage through perceived human resource management practices and trust in management." *Sustainability* 11.8 (2019): 2305.
- MyCert. Retrieved from <http://www.cybersecurity.my/en/index.html>. (2018)
- National Cyber Security Centre. "Common Cyber Attacks: Reducing The Impact." *Cyber Attacks White Paper* (2016).
- O'Brien, Wesley, Brian Cuthbert, and Niall McCarthy. "An Irish case study conversation: Gaelic games." *Learning to Mentor in Sports Coaching*. Routledge, 2018. 185-199.
- Samah, Irza Hanie Abu, et al. "Short And Long Term Effects Of Tourism Gdp Performance In Malaysia." *European Journal of Molecular & Clinical Medicine* 7.8 (2020): 1333-1341.
- Samah, Irza Hanie Abu, et al. "The impact of healthcare expenditure and healthcare sector growth on CO2 emission using dynamic panel data system GMM estimation model during COVID 19 crisis." *International Journal of Energy Economics and Policy* 10.6 (2020): 235.
- Stach, Stuart M., et al. "An ALMA survey of the SCUBA-2 Cosmology Legacy Survey UKIDSS/UDS field: number counts of submillimeter galaxies." *The Astrophysical Journal* 860.2 (2018): 161.
- Wei, Chu, et al. "Improving employee agility using enterprise social media and digital fluency: Moderated mediation model." *IEEE Access* 8 (2020): 68799-68810.
- Wood, Richard J., Laurie Tchack, and Shveta Taparia. "1, 25-Dihydroxyvitamin D 3 increases the expression of the CaT1 epithelial calcium channel in the Caco-2 human intestinal cell line." *BMC physiology* 1.1 (2001): 1-12.
- Yusoff, Wan Sallha, Intan Maizura Abd Rashid, and Suraiya Ibrahim. "Recent Performance In Singapore's Tourism Industry Using normality Test, Correlation&Regression Analysis: The Effect Of Medical Tourism, Service Sector & Exchange Rate." *European Journal of Molecular & Clinical Medicine* 7.8 (2020): 1354-1362.
- Zhao, Jane Y., et al. "Impact of trauma hospital ransomware attack on surgical residency training." *Journal of Surgical Research* 232 (2018): 389-397.