Challenges of Industry 4.0 in Indonesia: Case Study of the Tourism-Hospitality Sector

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Abstract

This research analyzes the relationship between five variables related to the challenges of industry 4.0 in Indonesia, namely internet users, number of rooms, number of guests, tourist visits, and work participation. Secondary data from the World Bank and UNWTO is used for the period 2000-2022. The vector autoregression (VAR) model is used to test the relationship between variables without distinguishing between endogenous and exogenous variables. The research results show that the relationships between variables are complex and dynamic over time. Internet users have a negative effect on work participation, tourist visits and number of guests, while the number of rooms has a positive effect on internet users and work participation. The number of guests and tourist visits have a positive effect on each other, but have a negative effect on internet users. Each variable is also influenced by the condition of the variable itself in the previous period.

Background

The tourism industry is one sector that has the potential to make a major contribution to the Indonesian economy. The industrial revolution 4.0 is marked by the use of digital technology, the internet, and artificial intelligence in various fields, including tourism (Widiastuti, Astawa, Mantra, & Susanti, 2021). This technology can help improve the efficiency, quality and competitiveness of the tourism industry, as well as provide a better experience for actors and users of tourism services. However, on the other hand, the industrial revolution 4.0 also brings challenges to the tourism industry, especially in terms of human resources (Pencarelli, 2020).

The industrial revolution 4.0 poses various challenges for the tourism sector, one of which is the quality and skills of human resources (Widarni, Prestianawati, & Bawono, 2020). The tourism industry needs human resources who are able to fill various positions, such as tour guides, hotel staff and chefs. However, the number and competency of human resources in this sector is still inadequate. The Covid-19 pandemic is changing consumer behavior and preferences, which requires the tourism industry to adapt quickly (Toubes, Araújo Vila, & Fraiz Brea, 2021). Apart from that, many workers in the tourism sector do not yet have the competencies that suit the needs of industry 4.0, such as foreign language skills, digital literacy and soft skills. These competencies are important to face changes in work patterns and more dynamic and competitive market demands in the industrial era 4.0. Human resources in the tourism industry must be able to learn throughout life, innovate and collaborate with various parties (Ellitan, 2020).

The Indonesian tourism industry is facing increasingly complex and dynamic challenges in the era of Industrial Revolution 4.0. This revolution demands an increase in the quality and readiness of human resources (HR) in the tourism industry so that they can compete and adapt to the changes that occur. Therefore, joint efforts are needed from the government, business world, universities, communities and society to increase the potential of human resources in the tourism industry (Jayabaya, Bekti, Sumadinata, & Widianingsih, 2021). One effort that can be made is to increase training and development of human resources in the tourism industry, both formally and informally. This training and development must use methods and media that are appropriate to the industrial era 4.0, such as e-learning, blended learning, and mobile learning. In addition, this training and development must be based on competency and market needs, and involve various stakeholders, such as tourism associations, industry and universities. The aim is to improve the knowledge, skills and professional attitudes of HR in the tourism industry, as well as to anticipate future HR needs (Priyambudi & Murdani, 2020). Industry 4.0 is an era of industrial revolution characterized by the incorporation of digital technology into conventional industrial production systems. The goal of this integration is to significantly improve productivity, efficiency and customer service. Industry 4.0 also brings various challenges, such as data security, workforce changes, digital inequality, and regulatory synchronization. To face this challenge, it is necessary to study various factors related to Industry 4.0, namely Internet Users, Number of Rooms, Total Guests, Tourism Arrivals, and Work Participation (Ramos & Brito, 2020).

Internet Users is the number of internet users in a country or region. Internet Users have a close relationship with Industry 4.0, because the internet is a technology that allows connectivity and data exchange between objects around us and activities or work automatically. Internet Users also show the level of digital literacy and access to information that people have in the Industry 4.0 era. Digital literacy and access to information are important to keep up with increasingly rapid technological developments and innovations4. Therefore, Internet Users can be an indicator of the readiness and ability of a country or region to face the challenges of Industry 4.0 (Nhamo, Nhemachena, & Nhamo, 2020). Number of Rooms is the number of rooms available in an accommodation, such as a hotel, inn or rental house. Number of Rooms has a significant relationship with Industry 4.0, because the number of rooms can influence the capacity and quality of services provided by the accommodation. In the Industry 4.0 era, accommodation places can take advantage of technology (Narayan, Gehlot, Singh, Akram, Priyadarshi, & Twala, 2022). Total Guests is the number of guests staying at an accommodation in a certain period. Total Guests has a relevant relationship with Industry 4.0, because the number of guests can indicate the level of demand and competition in the tourism sector. In the Industry 4.0 era, the tourism sector must be able to adapt to the increasingly diverse and dynamic needs and preferences of guests. Accommodation places must also be able to utilize data and analytics to increase guest loyalty and satisfaction (Ben Youssef, & Zeqiri, 2022). Tourism Arrival is the number of tourist visits to a country or region in a certain period. Tourism Arrival has an important relationship with Industry 4.0, because the number of tourist visits can show the potential and challenges in the tourism sector. In the Industry 4.0 era, the tourism sector must be able to face changes in tourist behavior and expectations which are increasingly digital and personal. The tourism sector must also be able to utilize technology to create innovative and sustainable products and services (Zeqiri, Dahmani, & Youssef, 2020).

Work Participation is the percentage of the population working or looking for work in a country or region. Work Participation has a strategic relationship with Industry 4.0, because the level of

work participation can indicate the availability and quality of human resources in the Industry 4.0 era. In the Industry 4.0 era, the workforce must be able to develop competencies and skills in accordance with the needs of an increasingly complex and dynamic industry. The workforce must also be able to adapt to changes in the work environment influenced by technology (Tortorella, Miorando, Caiado, Nascimento, & Portioli Staudacher, 2021). Industry 4.0 is a new era that integrates digital technology with existing industrial systems to improve performance and service. However, this era also raises challenges such as data security, workforce changes, digital divide, and regulations. Therefore, research on factors related to Industry 4.0, namely Internet Users, Number of Rooms, and others, is very necessary to provide insights, recommendations, and adaptations (Jan, Ahamed, Mayer, Patel, Grossmann, Stumptner, & Kuusk, 2023). This research aims to analyze the relationship between Internet Users, Number of Rooms, Total Guests, Tourism Arrivals, and Work Participation with the Challenges of Industry 4.0 in Indonesia.

Literature Review

The number of internet users in Indonesia continues to increase along with developments in information and communication technology. One of the benefits of using the internet is the ease of finding and booking accommodation online. With the existence of various digital platforms that provide information and hotel booking services, internet users can choose accommodation that suits their needs and budget. This has a positive impact on the number of hotel rooms in Indonesia, because it increases demand for lodging facilities. Internet Users is the number of people who use the internet in an area. Internet Users show the level of connectedness, digital literacy and access to information in the Industry 4.0 era. Internet Users are also a measure of readiness and ability to face the challenges of Industry 4.0 (Garg, 2020). Number of Rooms is the number of rooms available in the accommodation. Number of Rooms affects the income and reputation of the accommodation. The number of hotel rooms in Indonesia is one of the factors that influences the number of hotel guests in Indonesia. The availability of hotel rooms shows the capacity and quality of hotel services that can attract guests to stay. Apart from that, hotel rooms also influence the hotel occupancy rate, which is the ratio between the number of rooms used and the number of rooms available (Handani, Riswanto, & Kim, 2022).

Total Guests is the number of guests staying at an accommodation, such as a hotel or villa, in a certain period. This shows the performance and growth of the tourism sector in the Industry 4.0 era, which is challenged by developing technology and information. The number of hotel guests in Indonesia is one of the main indicators in measuring the performance of the tourism sector in Indonesia (Rahmayani, Oktavilia, Suseno, Isnaini, & Supriyadi, 2022). The number of hotel guests consists of domestic guests and foreign guests. Domestic guests are guests who are Indonesian citizens, while international guests are guests who are foreign citizens. The number of hotel guests is positively related to the number of tourist arrivals in Indonesia, because hotel guests are a source of income for the tourism industry. To compete, the tourism sector must meet the different needs and preferences of guests. Accommodation venues must use data and analytics to increase guest loyalty and satisfaction by providing tailored experiences and services (Martín, Rudchenko, & Sánchez-Rebull, 2020).

Tourism Arrival is the number of people visiting a tourist destination in a certain time. This relates to the Industry 4.0 era, where digital technology is increasingly advanced and integrated. With Industry 4.0, the tourism sector has the opportunity to increase the attractiveness and quality of tourist destinations, but also faces challenges from global competition and the environment (Streimikiene, Svagzdiene, Jasinskas, & Simanavicius, 2021). The number of

79

tourist arrivals in Indonesia is negatively related to the level of work participation in Indonesia. The number of tourist arrivals in Indonesia can have a substitution effect on local workers, namely when foreign workers replace local workers in doing certain jobs. This can happen because foreign workers have competitive advantages, such as better skills, experience or education than local workers (Yuliani, 2024).

Work Participation is the proportion of the population involved in economic activities, either as workers or job seekers, in a particular area. This is important to analyze in the context of Industry 4.0, which is characterized by the development of digital technology, automation and system integration. With Work Participation, we can assess the potential and readiness of human resources to face the challenges and opportunities in the Industry 4.0 era. The level of work participation in Indonesia is positively related to the challenges of industry 4.0 in Indonesia. Industry 4.0 is an era of industrial revolution marked by the use of digital technology, such as the internet of things, big data, artificial intelligence, and robotics, in production and business processes (Margherita & Bua, 2021). Industry 4.0 provides opportunities to increase efficiency, productivity and innovation, but also poses challenges for the workforce, such as competition, change and adaptation. The level of work participation reflects the readiness and competence of human resources in facing technological change (Molino, Cortese, & Ghislieri, 2020). Based on the results of previous research, we developed the following hypothesis:

H1. There is a positive relationship between the number of internet users and the number of hotel rooms in Indonesia, because internet users find it easier to find and book accommodation online.

H2. There is a positive relationship between the number of hotel rooms and the number of hotel guests in Indonesia, because the availability of hotel rooms shows the capacity and quality of hotel services.

H3. There is a positive relationship between the number of hotel guests and the number of tourist arrivals in Indonesia, because hotel guests are one of the main indicators in measuring the performance of the tourism sector.

H4. There is a negative relationship between the number of tourist arrivals and the level of work participation in Indonesia, because tourist arrivals have a substitution effect on the local workforce.

H5. There is a positive relationship between the level of work participation and the challenges of industry 4.0 in Indonesia, because work participation reflects the readiness and competence of human resources in facing technological change.

Research Methods

This research aims to analyze the relationship between Internet Users, Number of Rooms, Total Guests, Tourism Arrivals, and Work Participation with the Challenges of Industry 4.0 in Indonesia. We use secondary data from the world bank and the World Tourism Organization (UNWTO) with an annual period from 2000 to 2022. We present variable descriptions in table 1.

Table 1. Variable Description

Variable	Description	Unit of Account	Source
Internet User	Percentage of population who used the internet (from any location) in the last 3 months	Percent	World Bank
Number of Room	Number of rooms available in the listed tourist accommodation	Unit	UNWTO
Total Guest	The number of guests staying at the registered tourist accommodation	Orang	UNWTO
Tourism Arrival	Number of international tourist arrivals (both tourists and pilgrims)	Orang	UNWTO

Work Participation	Percentage of population aged 15 years and over who are involved in economic activities	Percent	World Bank

We use a vector autoregression model to correct the relationship of each variable. vector autoregression (VAR). VAR is a model that is used to analyze the relationship between several time series variables without the need to determine endogenous and exogenous variables. VAR can be used to test causality, predict and trace the impact of shocks on a variable system.

We performed a stationarity test on the data using the Augmented Dickey Fuller (ADF), Im-Pesaran-Shin, Levin, Lin & Chu t, and PP - Fisher Chi-square methods. If the data is not stationary, it is necessary to carry out transformations such as differencing or logging to make the data stationary. We determine the optimal lag length for the VAR model using information criteria such as the Akaike Information Criterion (AIC) or Schwarz Bayesian Criterion (SBC) that provide the minimum value. We estimate the VAR model using the Ordinary Least Square (OLS) method for each equation separately. The VAR model will have the following form:

$$\begin{bmatrix} IU_t \\ NR_t \\ TG_t \\ TA_t \\ WP_t \end{bmatrix} = \begin{bmatrix} c_1 \\ c_2 \\ c_3 \\ c_4 \\ c_5 \end{bmatrix} + \begin{bmatrix} a_{11} & a_{12} & a_{13} & a_{14} & a_{15} \\ a_{21} & a_{22} & a_{23} & a_{24} & a_{25} \\ a_{31} & a_{32} & a_{33} & a_{34} & a_{35} \\ a_{41} & a_{42} & a_{43} & a_{44} & a_{45} \\ a_{51} & a_{52} & a_{53} & a_{54} & a_{55} \end{bmatrix} \begin{bmatrix} IU_{t-1} \\ NR_{t-1} \\ TG_{t-1} \\ TA_{t-1} \\ WP_{t-1} \end{bmatrix} + \begin{bmatrix} e_{1t} \\ e_{2t} \\ e_{3t} \\ e_{4t} \\ e_{5t} \end{bmatrix}$$

Or separately it can be written as follows:

$$IU_t = c_1 + a_{11}IU_{t-1} + a_{12}NR_{t-1} + a_{13}TG_{t-1} + a_{14}TA_{t-1} + a_{15}WP_{t-1} + e_{1t}$$
$$NR_t = c_2 + a_{21}IU_{t-1} + a_{22}NR_{t-1} + a_{23}TG_{t-1} + a_{24}TA_{t-1} + a_{25}WP_{t-1} + e_{2t}$$
$$TG_t = c_3 + a_{31}IU_{t-1} + a_{32}NR_{t-1} + a_{33}TG_{t-1} + a_{34}TA_{t-1} + a_{35}WP_{t-1} + e_{3t}$$
$$TA_t = c_4 + a_{41}IU_{t-1} + a_{42}NR_{t-1} + a_{43}TG_{t-1} + a_{44}TA_{t-1} + a_{45}WP_{t-1} + e_{4t}$$
$$WP_t = c_5 + a_{51}IU_{t-1} + a_{52}NR_{t-1} + a_{53}TG_{t-1} + a_{54}TA_{t-1} + a_{55}WP_{t-1} + e_{5t}$$

where IU is Internet User. NR is Number of Rooms, TG is Total Guests. TA is Tourism Arrival. WP is Work Participation. α is the coefficient, t is the time series, c is the constant, e is the error term. We conducted an Impulse Response Function (IRF) test to explore the impact of shocks in one variable on other variables in the model. IRF describes how a variable responds to a shock of one standard deviation unit in another variable in a certain time period. We carry out the Variance Decomposition (VD) test to measure the contribution of shocks to one variable to the variance of other variables in the model. VD decomposes the variance of a variable into parts caused by shocks to the variable itself and other variables in a certain time period. We analyzed and interpreted the results of the VAR model, IRF test, and VD test. We summarize the research findings and provide appropriate policy suggestions or implications.

Results and Discussion

Descriptive statistics are very important because they have functions and benefits such as providing an overview and description of the information contained in the data, explaining the characteristics of the data, making it easier to read and analyze the data, presenting the data more concisely in tabular form, providing a basis for further statistical analysis. Descriptive statistics are presented in table 2.

Table 2. Statistical Description

	Work Participation	Tourism Arrival	Total Guest	Number Of Room	Internet User
Mean	6.658.100	7571472.	61946.57	453705.2	1.993.970
Median	6.658.300	6234000.	49704.00	381457.0	1.228.000

Maximum	6.960.000	16107000	132690.0	870783.0	6.648.461
Minimum	6.420.800	4032189.	29794.00	252984.0	0.925564
Std. Dev.	1.137.445	3707177.	34785.41	200041.6	2.052.200
Skewness	0.273602	1.170.272	1.060.790	0.770812	1.079.560
Kurtosis	4.236.797	3.213.233	2.755.899	2.182.831	2.861.163
Jarque-Bera	1.752.886	5.293.467	4.370.659	2.917.521	4.486.031
Probability	0.416261	0.070882	0.112441	0.232524	0.106138
Sum	1.531.363	1.74E+08	1424771.	10435220	4.586.130
Sum Sq. Dev.	2.846.317	3.02E+14	2.66E+10	8.80E+11	9.265.354
Observations	23	23	23	23	23

Work Participation is the number of people working or looking for work in a region or country. The average (mean) value of this variable is 6,658,100 people, which means around 6.7 million people participate in the job market. The middle value (median) of this variable is 6,658,300 people, which means that half of the data is below and half is above this value. The maximum value of this variable is 6,960,000 people, which means there is one region or country that has the highest work participation. The minimum value of this variable is 6,420,800 people, which means there is one region or country that has the lowest work participation. The standard deviation (std. dev.) value of this variable is 1,137,445 people, which means how much the data varies from the average value. The skewness value of this variable is 0.273602, which means the data tends to be symmetrical or not skewed to the left or right. The kurtosis value of this variable is 4,236,797, which means the data has a higher peak and thicker tails than a normal distribution. The Jarque-Bera value of this variable is 1,752,886, which means the statistical value to test whether the data is normally distributed or not. The probability value of this variable is 0.416261, which means the opportunity to reject the null hypothesis that the data is normally distributed. The sum value of this variable is 1,531,363 people, which means the total work participation from all regions or countries. The value of the sum of squared deviations (sum sq. dev.) of this variable is 2,846,317 people, which means the total squared difference between each data and the average value. The observation value of this variable is 23, which means the number of samples or data used.

Tourism Arrival is the number of tourists who come to a region or country in a certain period. The average (mean) value of this variable is 7,571,472 people, which means around 7.6 million tourists visit a region or country. The middle value (median) of this variable is 6,234,000 people, which means that half of the data is below and half is above this value. The maximum value of this variable is 16,107,000 people, which means there is one region or country that has the highest tourist visits. The minimum value of this variable is 4,032,189 people, which means there is one region or country that has the lowest tourist visits. The standard deviation (std. dev.) value of this variable is 3,707,177 people, which means how much the data varies from the average value. The skewness value of this variable is 1,170,272, which means the data tends to skew to the right or has a longer right tail. The kurtosis value of this variable is 3,213,233, which means the data has a higher peak and thicker tails than a normal distribution. The Jarque-Bera value of this variable is 5,293,467, which means the statistical value to test whether the data is normally distributed or not. The probability value of this variable is 0.070882, which means the opportunity to reject the null hypothesis that the data is normally distributed. The sum value of this variable is 1.74E+08 people, which means the total number of tourist visits from all regions or countries. The value of the sum of squared deviations (sum sq. dev.) of this variable is 3.02E+14 people, which means the total squared difference between each data and the average

value. The observation value of this variable is 23, which means the number of samples or data used.

Total Guests is the number of guests staying at a tourist accommodation in a certain period. The average (mean) value of this variable is 61,946.57 people, which means around 62 thousand guests stay at a tourist accommodation. The middle value (median) of this variable is 49,704 people, which means that half of the data is below and half is above this value. The maximum value of this variable is 132,690 people, which means there is one tourist accommodation that has the highest number of guests. The minimum value of this variable is 29,794 people, which means there is one tourist accommodation that has the lowest number of guests. The standard deviation value (std. dev.) of this variable is 34,785.41 people, which means how much variation the data has from the average value. The skewness value of this variable is 1,060,790, which means the data tends to skew to the right or has a longer right tail. The kurtosis value of this variable is 2,755,899, which means the data has a higher peak and thicker tails than a normal distribution. The Jarque-Bera value of this variable is 4,370,659, which means the statistical value to test whether the data is normally distributed or not. The probability value of this variable is 0.112441, which means the opportunity to reject the null hypothesis that the data is normally distributed. The sum value of this variable is 1,424,771 people, which means the total number of guests staying in all tourist accommodation. The value of the sum of squared deviations (sum sq. dev.) of this variable is 2.66E+10 people, which means the total squared difference between each data and the average value. The observation value of this variable is 23, which means the number of samples or data used.

Number Of Rooms is the number of rooms available in a tourist accommodation in a certain period. The average (mean) value of this variable is 453,705.2 people, which means around 454 thousand rooms are available in a tourist accommodation. The middle value (median) of this variable is 381,457 people, which means that half of the data is below and half is above this value. The maximum value of this variable is 870,783 people, which means there is one tourist accommodation that has the highest number of rooms. The minimum value of this variable is 252,984 people, which means there is one tourist accommodation that has the lowest number of rooms. The standard deviation (std. dev.) value of this variable is 200,041.6 people, which means how much the data varies from the average value. The skewness value of this variable is 0.770812, which means the data tends to skew to the right or has a longer right tail. The kurtosis value of this variable is 2,182,831, which means the data has a lower peak and thinner tails than a normal distribution. The Jarque-Bera value of this variable is 2,917,521, which means the statistical value to test whether the data is normally distributed or not. The probability value of this variable is 0.232524, which means the opportunity to reject the null hypothesis that the data is normally distributed. The sum value of this variable is 10,435,220 people, which means the total rooms available in all tourist accommodation. The value of the sum of squared deviations (sum sq. dev.) of this variable is 8.80E+11 people, which means the total squared difference between each data and the average value. Observation value of this variable.

Table 3. Stationarity Test

Method	Statistic	Prob.**	Cross-sections	Obs
Null: Unit root (assumes common unit root process)				
Levin, Lin & Chu t*	-162.320	0.0523	5	94
Null: Unit root (assumes individual unit root process)				
Im, Pesaran and Shin W-stat	-397.301	0.0000	5	94
ADF - Fisher Chi-square	379.986	0.0000	5	94

PP - Fisher Chi-square		699.515	0.0000	5	105

Levin, Lin & Chu (LLC) test is a method for testing the presence of unit roots in panel data. The unit root means that the Variable is not stationary, that is, it has a mean and variance that change over time. The LLC test assumes that all panels have the same autoregressive coefficients, but allows for heterogeneity in individual effects and serial correlation structures. In the Levin, Lin & Chu (LLC) test, the t statistic is -162.320 and the probability is 0.0523. This means that it can reject the null hypothesis at the 5% significance level, but not at the 1% significance level. In other words, we have fairly strong, but not very strong, evidence that our Variable is stationary in the data. Im, Pesaran and Shin W-stat is a unit root test for heterogeneous data panels. The null hypothesis of this test is that all panels contain unit roots, while the alternative hypothesis is that at least one panel is stationary. This test uses the average t-statistic from the augmented Dickey-Fuller regression for each panel. Probability is the probability of incorrectly rejecting the null hypothesis. The smaller the probability value, the stronger the evidence to reject the null hypothesis. Based on table 3, the W-stat value is -397.301 and the probability is 0.0000. This means the null hypothesis is rejected with a very high level of significance, and concludes that there is at least one stationary panel in the data.

ADF - Fisher Chi-square is a unit root test that tests the null hypothesis that all panels have a unit root. The alternative hypothesis is that at least one panel is stationary. This test is based on the Dickey-Fuller test extended to include a higher order regressive process in the test statistical model is 379.986 and the probability is 0.0000. This means that the probability is very small and much less than the common level of significance. Therefore, it can reject the null hypothesis and conclude that at least one panel is stationary. This shows that the data has no unit root and is stationary. PP - Fisher Chi-square is a method for testing hypotheses about the relationship between two categorical variables. PP statistic - Fisher Chi-square is the sum of the PP statistics (Phillips-Perron) for each unit in panel data. The probability for Fisher's test is calculated using the asymptotic Chi-square distribution. The Prob value is 0.0000, which means it is very small. This shows that there is a significant relationship between the two categorical variables tested. We can reject the null hypothesis with a high degree of confidence and conclude that the data is stationary.

Table 4. VAR Lag Order Selection Criteria

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-9.336.297	NA	4.58e+32	89.39331	89.64200	89.44728
1	-8.322.852	144.7779	3.46e+29	82.12240	83.61457	82.44624
2	-7.755.631	54.02105*	2.77e+28*	79.10124*	81.83690*	79.69495*

The VAR lag selection criterion is a statistical measure that helps select the optimal number of lags for a vector autoregressive (VAR) model. These criteria are based on different trade-offs between model suitability and model complexity. The lower the criterion value, the better the model. Based on table 4, the asterisk indicates the lowest value for each criterion. Based on table 4, the optimal lag order is 2, because it minimizes the FPE, AIC and HQ criteria. The LR test also supports this choice, as it is significant at the 5% level for the second lag. The SC criterion suggests a lag order lower than 0, but this may result in a poorly fitting model that misses important dynamics. Therefore, lag sequence 2 is the best choice for the VAR model.

Table 5. Vector Autoregression Estimates

	Work	Tourism	Total Guest	Number Of	Internet

84

	Participation	Arrival		Room	User
Work Participation(-2)	-0.184794	-51447.72	2.191.644	-2.617.293	-0.064013
	(0.19036)	(258709.)	(4562.67)	(5012.75)	(0.33662)
	[-0.97079]	[-0.19886]	[0.48034]	[-0.52213]	[-0.19016]
Tourism Arrival(-2)	1.10E-08	-0.332893	-0.001331	0.018838	3.12E-07
	(1.9E-07)	(0.25291)	(0.00446)	(0.00490)	(3.3E-07)
	[0.05922]	[-1.31626]	[-0.29846]	[3.84418]	[0.94791]
Total Guest(-2)	-4.80E-05	-1.407.422	-1.694.591	-2.660.695	-6.43E-05
	(3.7E-05)	-498.828	(0.87975)	(0.96653)	(6.5E-05)
	[-1.30646]	[-2.82146]	[-1.92622]	[-2.75283]	[-0.99079]
Number Of Room(-2)	1.19E-05	1.127.101	0.955659	0.181492	3.23E-05
	(9.4E-06)	-128.085	(0.22589)	(0.24818)	(1.7E-05)
	[1.26414]	[8.79967]	[4.23057]	[0.73130]	[1.93835]
Internet User(-2)	-0.109609	-1174819.	-9.013.620	2.542.762	0.052987
	(0.18669)	(253734.)	(4474.93)	(4916.36)	(0.33015)
	[-0.58710]	[-4.63012]	[-2.01425]	[0.51720]	[0.16049]
C	3.350.287	-47260514	-387126.7	764930.4	2.596.220
	-157.901	(2.1E+07)	(378478.)	(415813.)	-279.229
	[2.12176]	[-2.20224]	[-1.02285]	[1.83960]	[0.92978]
R-Squared	0.741569	0.969544	0.888258	0.995842	0.998250
Adj. R-Squared	0.483138	0.939087	0.776517	0.991684	0.996500
Sum Sq. Resids	4.766.144	8.80E+12	2.74E+09	3.31E+09	1.490.447
S.E. Equation	0.690373	938277.5	16547.73	18180.07	1.220.839
F-Statistic	2.869.507	3.183.386	7.949.222	2.395.072	5.704.856
Log Likelihood	-1.422.637	-3.107.952	-2.260.015	-2.279.771	-2.619.767
Akaike AIC	2.402.511	3.064.716	2.257.157	2.275.972	3.542.635
Schwarz SC	2.949.642	3.119.429	2.311.870	2.330.685	4.089.766
Mean Dependent	6.641.114	7806041.	64906.00	472513.6	2.169.851
S.D. Dependent	0.960277	3801695.	35003.87	199363.1	2.063.697

The coefficient for Work Participation(-2) is -0.184794, which means that a one unit increase in Work Participation two previous periods will reduce current Work Participation by 0.184794 units. This coefficient is not statistically significant, because its t statistic is -0.97079, which is smaller than the critical value at the 5% significance level (approximately -1.96). The coefficient for Tourism Arrival is -51447.72, which means that a one unit increase in Tourism Arrival in the same period will reduce Work Participation by 51447.72 units. This coefficient is also not statistically significant, as its t statistic is -0.19886, which is smaller than the critical value at the 5% significance level. The coefficient for Total Guests is 2,191,644, which means that a one unit increase in Total Guests in the same period will increase Work Participation by 2,191,644 units. This coefficient is statistically significant, as its t statistic is 0.48034, which is greater than the critical value at the 5% significance level (approximately 1.96). The coefficient for Number Of Room is -2,617,293, which means that a one unit increase in Number Of Room in the same period will reduce Work Participation by 2,617,293 units. This coefficient is not statistically significant, because its t statistic is -0.52213, which is smaller than the critical value at the 5%

significance level. The coefficient for Internet Users is -0.064013, which means that a one unit increase in Internet Users in the same period will reduce Work Participation by 0.064013 units. This coefficient is not statistically significant, because its t statistic is -0.19016, which is smaller than the critical value at the 5% significance level.

The regression coefficient for the Work Participation Variable is $1.10{\times}10{-}8$, which means that if Tourism Arrival(-2) increases by one unit, then Work Participation will increase by $1.10{\times}10{-}8$ units, assuming other variables remain constant. The t-statistic value for this coefficient is 0.05922, which means this coefficient is not statistically significant at the 5% significance level. The regression coefficient for the Tourism Arrival variable is -0.332893, which means that if Tourism Arrival(-2) increases by one unit, then Tourism Arrival will decrease by 0.332893 units, assuming other variables remain constant. The t-statistic value for this coefficient is -1.31626, which means this coefficient is not statistically significant at the 5% significance level. The regression coefficient for the Total Guest Variable is -0.001331, which means that if Tourism Arrival(-2) increases by one unit, then Total Guest will decrease by 0.001331 units, assuming the other variables remain constant. The t-statistic value for this coefficient is -0.29846, which means this coefficient is not statistically significant at the 5% significance level. The regression coefficient for the Number Of Room Variable is 0.018838, which means that if Tourism Arrival(-2) increases by one unit, then the Number Of Room will increase by 0.018838 units, assuming the other variables remain constant. The t-statistic value for this coefficient is 3.84418, which means this coefficient is statistically significant at the 5% significance level. The regression coefficient for the Internet User variable is $3.12{\times}10{-}7$, which means that if Tourism Arrival(-2) increases by one unit, then Internet Users will increase by $3.12{\times}10{-}7$ units, assuming other variables remain constant. The t-statistic value for this coefficient is 0.94791, which means this coefficient is not statistically significant at the 5% significance level. An increase of one unit in Total Guests(-2) is associated with a decrease of 4.80E-05 Work Participation. An increase of one unit in Total Guests(-2) is associated with a decrease of 1,407,422 Tourism Arrivals. An increase of one unit in Total Guests(-2) is associated with a decrease of 1,694,591 Total Guests .A one unit increase in Total Guests(-2) corresponds to a decrease of 2,660,695 Number Of Rooms. A one unit increase in Total Guests(-2) is associated with a decrease in 6.43E-05 Internet Users. An increase of one unit in Number Of Room(-2) corresponds to an increase of 1.19E-05 Work Participation, while an increase of one unit of Internet User(-2) corresponds to a decrease of 0.109609 Work Participation. An increase of one unit in Number Of Room(-2) corresponds to an increase 1,127,101 Tourism Arrivals, while an increase of one unit of Internet User(-2) is associated with a decrease of 1,174,819 Tourism Arrivals. An increase of one unit of Number Of Rooms(-2) is associated with an increase of 0.955659 Total Guests, while an increase of one unit of Internet User(- 2) corresponds to a decrease of 9,013,620 Total Guests. An increase of one unit in Number Of Rooms (-2) corresponds to an increase of 0.181492 Number Of Rooms, while an increase of one unit of Internet Users (-2) corresponds to an increase of 2,542,762 Number Of Rooms. Increase one unit of Number Of Room(-2) corresponds to an increase of 3.23E-05 Internet Users, while an increase of one unit of Internet User(-2) corresponds to an increase of 0.052987 Internet Users.

Relationship between constant C and other variables at time t. The coefficient represents the change in the dependent variable for a one unit change in the constant C. A one unit increase in C corresponds to an increase of 3,350,287 Work Participation. This effect is significant at the 95% confidence level, because the t-statistic value is greater than 2. An increase of one C unit is associated with a decrease of 47,260,514 Tourism Arrivals. This effect is significant at the 95%

confidence level, because the t-statistic value is smaller than -2. An increase of one C unit is associated with a decrease of 387,126.7 Total Guests. This effect is not significant at the 95% confidence level, because the t-statistic value is between -2 and 2. An increase of one C unit corresponds to an increase of 764,930.4 Number Of Rooms. This effect is significant at the 95% confidence level, because the t-statistic value is greater than 2. R-Squared is a measure that shows how much variation in the data can be explained by the model. The R-Squared value ranges from 0 to 1, where 0 means the model cannot explain data variations at all, and 1 means the model can explain data variations perfectly. The higher the R-Squared value, the better the model. From the results, it seems that all variables have a high R-Squared, especially Number Of Rooms and Internet Users which are almost close to 1. This means the model can explain most of the data variations for these variables. Adj. R-Squared is an R-Squared adjustment that considers the number of variables in the model. If you add variables to the model, the R-Squared value will increase, but this does not always mean the model is better. Therefore, it is necessary to use Adj. R-Squared to compare models with a different number of variables. Adj Value R-Squared also ranges from 0 to 1, but is usually lower than R-Squared. The higher the value of Adj. R-Squared, the better the model. From the results, it seems that all Variables have Adj. R-Squared is high, except for Work Participation which is quite low. This means the model is not too complex and not overfitting, but may be less suitable for explaining data variation for Variable Work Participation. Sum Sq. Resids is the sum of squared residuals, i.e. the difference between the actual value and the value predicted by the model. The residual shows how much error the model has. Sum Sq Value. Low residuals means the model has small errors, and vice versa. From the results, it seems that Variable Work Participation and Internet User have Sum Sq. Resids are low, while Variable Tourism Arrival has a Sum Sq. Very high recids. This means the model has a small error for Variable Work Participation and Internet User, but has a large error for Variable Tourism Arrival.

S.E. Equation is the standard error of the equation, which is a measure of the uncertainty of the model coefficient estimates. The value of S.E. A low equation means the estimated coefficient is more accurate. From the results, it seems that Variable Work Participation and Internet User have S.E. Equation is low, while Variable Tourism Arrival has S.E. Very high equation. The F-Statistic is a statistic used to test the null hypothesis that all coefficients in the model are equal to zero. A high F-Statistic value means the model is statistically significant. From the results, it seems that the Variable Total Guests has the highest F-Statistic, while the Variable Number Of Rooms has the lowest F-Statistic. Log Likelihood is the logarithm value of the model's likelihood function, which is a measure of how well the model fits the data. A high Log Likelihood value means the model fits the data better. From the results, it seems that the Work Participation Variable has the highest Log Likelihood, while the Tourism Arrival Variable has the lowest Log Likelihood. Akaike AIC is the Akaike information criterion, which is a measure that considers both model suitability and model complexity. A low Akaike AIC value means the model is better. From the results, it seems that the Variable Total Guest and Number Of Rooms have a low Akaike AIC, while the Variable Internet User has a high Akaike AIC. Schwarz SC is the Schwarz information criterion, which is a measure similar to Akaike AIC, but imposes a greater penalty on model complexity. A low Schwarz SC value means the model is better. From the results, it seems that the Variable Total Guest and Number Of Rooms have a low Schwarz SC, while the Variable Internet User has a high Schwarz SC. Mean Dependent is the average of the dependent variable, which is a measure that shows the middle value of the data. The Mean Dependent value is different for each variable, depending on the scale and units of measurement.

From the results, it seems that the Tourism Arrival Variable has the highest Mean Dependent, while the Internet User Variable has the lowest Mean Dependent. S.D. Dependent is the standard deviation of the dependent variable, which is a measure that shows how varied the data is. S.D. value High dependency means the data is more spread out, while the S.D. Low dependency means the data is more concentrated. From the results, it seems that Variable Tourism Arrival has S.D. Dependent is the highest, while Variable Internet User has S.D. Lowest dependency.

Table 6. Impulse Response Function test

Response of Work Participation:				
Period	Work Participation	Tourism Arrival	Total Guest	Number Of Room	Internet User
1	0.690373	0.000000	0.000000	0.000000	0.000000
2	0.360557	0.136533	0.084734	0.153591	-0.062395
3	-0.079226	-0.033567	0.222456	0.385175	-0.229297
4	-0.193666	0.044760	0.222986	0.339785	-0.267432
5	-0.081541	0.315787	0.110909	0.176081	-0.197356
Response of Tourism Arrival:					
Period	Work Participation	Tourism Arrival	Total Guest	Number Of Room	Internet User
1	211875.1	914042.5	0.000000	0.000000	0.000000
2	-570640.8	1296760.	1431581.	948885.5	-656072.8
3	-1375269.	879520.3	2116036.	1870944.	-1570657.
4	-413202.2	1823761.	1122667.	1040474.	-1193123.
5	-879335.2	1336288.	1925870.	2214767.	-2154748.
Response of Total Guest:					
Period	Work Participation	Tourism Arrival	Total Guest	Number Of Room	Internet User
1	-8.079.473	15049.31	6833.218	0.000000	0.000000
2	-6.696.760	8792.630	10176.41	9335.249	-6.132.216
3	-10111.06	5759.406	16573.62	15971.94	-12509.07
4	-3.785.390	15334.67	9765.489	9512.527	-10272.68
5	-7.456.031	13925.71	16380.30	18345.65	-17467.48
Response of Number Of Room:					
Period	Work Participation	Tourism Arrival	Total Guest	Number Of Room	Internet User
1	-8.141.627	-1.135.633	6033.831	15050.99	0.000000
2	-4.085.342	28676.87	5771.285	2587.239	4616.540
3	-18280.28	3265.572	9618.093	28812.72	-10171.27
4	-29866.02	26701.74	45204.80	40146.41	-24940.23
5	-20659.28	51120.33	26723.12	30632.27	-23056.92
Response of Internet User:					
Period	Work Participation	Tourism Arrival	Total Guest	Number Of Room	Internet User
1	0.062851	-0.230322	-0.705730	0.369176	0.893925
2	-0.641786	0.188957	-0.010959	0.686138	0.406676
3	-0.996213	0.546134	0.183015	1.068696	0.258781
4	-1.285.812	1.336810	0.754058	1.518263	-0.106215
5	-2.022.470	1.985905	1.947887	2.658607	-1.030.698

Response of Work Participation which measures the relationship between work participation and other variables such as tourist visits, number of guests, number of rooms, and internet users. Work Participation is a dependent variable that shows the level of work participation of the

population. The regression coefficient value for this variable is constant or intercept, which means the average value of work participation when all independent variables are zero1. The regression coefficient value for this variable is 0.690373 in period 1, which decreases to 0.360557 in period 2, and continues to decrease until period 5. This means that work participation tends to decrease over time.

Tourism Arrival is an independent variable that shows the number of tourist visits to an area. The regression coefficient value for this variable shows how big the influence of tourist visits is on work participation1. The regression coefficient value for this variable is 0 in period 1, which means there is no relationship between tourist visits and work participation in that period. The regression coefficient value for this variable increased to 0.136533 in period 2, which means there is a positive relationship between tourist visits and work participation in that period. This means that the more tourist visits, the higher the work participation. The regression coefficient value for this variable fluctuates in periods 3, 4, and 5, indicating that the relationship between tourist visits and work participation is not consistent over time. Total Guests is an independent variable that shows the number of guests staying in an area. The regression coefficient value for this variable shows how much influence the number of guests has on work participation1. The regression coefficient value for this variable is 0 in period 1, which means there is no relationship between the number of guests and work participation in that period. The regression coefficient value for this variable increased to 0.084734 in period 2, which means there is a positive relationship between the number of guests and work participation in that period. This means that the more guests staying, the higher the work participation. The regression coefficient value for this variable increased again to 0.222456 in period 3, and remained stable in periods 4 and 5. This means that the relationship between the number of guests and work participation is quite strong and does not change over time. Number Of Rooms is an independent variable that shows the number of rooms available in an area. The regression coefficient value for this variable shows how much influence the number of rooms has on work participation1. The regression coefficient value for this variable is 0 in period 1, which means there is no relationship between the number of rooms and work participation in that period. The regression coefficient value for this variable increased to 0.153591 in period 2, which means there is a positive relationship between the number of rooms and work participation in that period. This means that the more rooms available, the higher the work participation. The regression coefficient value for this variable increased again to 0.385175 in period 3, which is the highest value among all variables. This means that the number of rooms has the greatest influence on work participation in that period. The regression coefficient value for this variable decreased slightly to 0.339785 in period 4, and decreased again to 0.176081 in period 5. This means that the effect of the number of rooms on work participation decreases as time goes by.

Internet User is an independent variable that shows the number of internet users in an area. The regression coefficient value for this variable shows how much influence internet users have on work participation. The regression coefficient value for this variable is 0 in period 1, which means there is no relationship between internet users and work participation in that period. The regression coefficient value for this variable becomes negative in periods 2, 3, 4, and 5, which means there is a negative relationship between internet users and work participation in these periods. This means that the more internet users there are, the lower the work participation. The regression coefficient value for this variable is -0.062395 in period 2, which decreases to -0.229297 in period 3, -0.267432 in period 4, and -0.197356 in period 5. This means that the influence of internet users on work participation is getting bigger and negative over time.

Response of Tourism Arrival which measures the relationship between foreign tourist visits and other variables such as work participation, number of guests, number of rooms, and internet users. Tourism Arrival is a dependent variable that shows the number of foreign tourist visits to Indonesia. The coefficient of determination value for this variable is constant or intercept, which means the average value of foreign tourist visits when all independent variables are zero1. The coefficient of determination value for this variable is 914042.5 in period 1, which increases to 1296760 in period 2, and continues to increase until period 4. This means that foreign tourist visits tend to increase over time. However, the coefficient of determination value for this variable decreased to 1336288 in period 5, which means there was a decrease in foreign tourist visits in that period.

Work Participation is an independent variable that shows the level of work participation of the population. The coefficient of determination value for this variable shows how much influence work participation has on foreign tourist visits1. The coefficient of determination value for this variable is 211875.1 in period 1, which means there is a positive relationship between work participation and foreign tourist visits in that period. This means that the higher the work participation, the more foreign tourists will visit. However, the coefficient of determination value for this variable becomes negative in periods 2, 3, 4, and 5, which means there is a negative relationship between work participation and foreign tourist visits in these periods. This means that the lower the work participation, the more foreign tourists visit. The coefficient of determination value for this variable is -570640.8 in period 2, which decreases to -1375269 in period 3, -413202.2 in period 4, and -879335.2 in period 5. This means that the influence of work participation on foreign tourist visits is getting bigger and negative throughout time. Total Guests is an independent variable that shows the number of guests staying in Indonesia. The coefficient of determination value for this variable shows how much influence the number of guests has on foreign tourist visits1. The coefficient of determination value for this variable is 0 in period 1, which means there is no relationship between the number of guests and foreign tourist visits in that period. The coefficient of determination value for this variable increased to 1431581 in period 2, which means there is a positive relationship between the number of guests and foreign tourist visits in that period. This means that the more guests who stay, the more foreign tourists will visit. The coefficient of determination value for this variable increased again to 2116036 in period 3, and decreased to 1122667 in period 4, and 1925870 in period 5. This means that the relationship between the number of guests and foreign tourist visits is not consistent over time.

Number Of Rooms is an independent variable that shows the number of rooms available in Indonesia. The coefficient of determination value for this variable shows how much influence the number of rooms has on foreign tourist visits1. The coefficient of determination value for this variable is 0 in period 1, which means there is no relationship between the number of rooms and foreign tourist visits in that period. The coefficient of determination value for this variable increased to 948885.5 in period 2, which means there is a positive relationship between the number of rooms and foreign tourist visits in that period. This means that the more rooms available, the more foreign tourists will visit. The coefficient of determination value for this variable increased again to 1870944 in period 3, which is the highest value among all variables. This means that the number of rooms has the greatest influence on foreign tourist visits in that period. The coefficient of determination value for this variable decreased to 1040474 in period 4, and increased again to 2214767 in period 5. This means that the influence of the number of rooms on foreign tourist visits fluctuates over time. Internet User is an independent variable that shows the number of internet users in Indonesia. The coefficient of determination value for this

variable shows how much influence internet users have on foreign tourist visits1. The coefficient of determination value for this variable is 0 in period 1, which means there is no relationship between internet users and foreign tourist visits in that period. The coefficient of determination value for this variable becomes negative in periods 2, 3, 4, and 5, which means there is a negative relationship between internet users and foreign tourist visits in these periods. This means that the more internet users there are, the fewer visits by foreign tourists. The coefficient of determination for this variable is -656072.8 in period 2, which decreases to -1570657 in period 3, -1193123 in period 4, and -2154748 in period 5. This means that the influence of internet users on foreign tourist visits is getting bigger and negative throughout time.

Response of Total Guest which measures the relationship between the number of guests staying in Indonesia and other variables such as work participation, foreign tourist visits, number of rooms, and internet users. Total Guest is a dependent variable which shows the number of guests staying in Indonesia. The correlation coefficient value for this variable is constant or intercept, which means the average value of the number of guests staying when all independent variables are zero1. The correlation coefficient value for this variable was 6833.218 in period 1, which increased to 10176.41 in period 2, and continued to increase until period 5. This means that the number of guests staying overnight tends to increase as time goes by. Work Participation is an independent variable that shows the level of work participation of the population. The correlation coefficient value for this variable shows how strong and directional the relationship is between work participation and the number of guests staying overnight1. The correlation coefficient value for this variable is -8,079,473 in period 1, which means there is a very strong negative relationship between work participation and the number of guests staying overnight in that period. This means that the lower the work participation, the more guests stay overnight. The correlation coefficient value for this variable becomes smaller (but remains negative) in periods 2, 3, 4, and 5, which means the relationship between work participation and the number of guests staying overnight becomes weaker (but still negative) in these periods. This means that the effect of work participation on the number of guests staying overnight decreases over time.

Tourism Arrival is an independent variable that shows the number of foreign tourist visits to Indonesia. The correlation coefficient value for this variable shows how strong and unidirectional the relationship is between foreign tourist visits and the number of guests staying1. The correlation coefficient value for this variable is 15049.31 in period 1, which means there is a very strong positive relationship between foreign tourist visits and the number of guests staying overnight in that period. This means that the more foreign tourists visit, the more guests stay overnight. The correlation coefficient value for this variable becomes smaller (but remains positive) in periods 2, 3, and 5, which means the relationship between foreign tourist visits and the number of guests staying overnight becomes weaker (but still positive) in these periods. This means that the influence of foreign tourist visits on the number of guests staying overnight has decreased over time. However, the correlation coefficient value for this variable increased to 15334.67 in period 4, which means there was an increase in the relationship between foreign tourist visits and the number of guests staying overnight in that period.

Number Of Rooms is an independent variable that shows the number of rooms available in Indonesia. The correlation coefficient value for this variable shows how strong and unidirectional the relationship is between the number of rooms and the number of guests staying1. The correlation coefficient value for this variable is 0 in period 1, which means there is no relationship between the number of rooms and the number of guests staying in that period. The correlation coefficient value for this variable increased to 9335.249 in period 2, which

91

means there is a strong positive relationship between the number of rooms and the number of guests staying in that period. This means that the more rooms available, the more guests will stay. The correlation coefficient value for this variable increased again to 15971.94 in period 3, which is the highest value among all variables. This means that the number of rooms has the strongest and most direct relationship with the number of guests staying in that period. The correlation coefficient value for this variable decreased to 9512.527 in period 4, and increased again to 18345.65 in period 5. This means that the relationship between the number of rooms and the number of guests staying fluctuates over time.

Internet User is an independent variable that shows the number of internet users in Indonesia. The correlation coefficient value for this variable shows how strong and directional the relationship is between internet users and the number of guests staying overnight1. The correlation coefficient value for this variable is 0 in period 1, which means there is no relationship between internet users and the number of guests staying in that period. The correlation coefficient value for this variable becomes negative in periods 2, 3, 4, and 5, which means there is a negative relationship between internet users and the number of guests staying overnight in these periods. This means that the more internet users there are, the fewer guests stay overnight. The correlation coefficient value for this variable is -6,132,216 in period 2, which decreases to -12,509.07 in period 3, -10,272.68 in period 4, and -17,467.48 in period 5. This means that the relationship between internet users and the number of guests staying overnight is increasing. strong and in the opposite direction all the time. Response of Number of Rooms is an analysis that makes the number of rooms available in Indonesia the dependent variable. The regression coefficient value for this variable is constant or intercept, which means the average value of the number of rooms available when all independent variables are zero. The regression coefficient value for this variable is 15050.99 in period 1, which decreases to 2587.239 in period 2, and continues to increase until period 5. This means that the number of available rooms tends to increase over time, but at different rates.

Work Participation is an independent variable that shows the level of work participation of the population. The regression coefficient value for this variable shows how much influence work participation has on the number of rooms available. The regression coefficient value for this variable is -8,141,627 in period 1, which means there is a very large negative relationship between work participation and the number of rooms available in that period. That is, the lower the work participation, the more rooms are available. The regression coefficient value for this variable becomes smaller (but still negative) in periods 2, 3, 4, and 5, which means the relationship between work participation and the number of rooms available becomes smaller (but still negative) in these periods. That is, the effect of work participation on the number of rooms available decreases over time. Tourism Arrival is an independent variable that shows the number of foreign tourist visits to Indonesia. The regression coefficient value for this variable shows how much influence foreign tourist visits have on the number of rooms available. The regression coefficient value for this variable is -1,135,633 in period 1, which means there is a large negative relationship between foreign tourist visits and the number of rooms available in that period. This means that the more foreign tourists visit, the fewer rooms are available. The regression coefficient value for this variable becomes positive in periods 2, 3, 4, and 5, which means there is a positive relationship between foreign tourist visits and the number of rooms available in these periods. This means that the more foreign tourists visit, the more rooms are available. The regression coefficient value for this variable is 28676.87 in period 2, which increases to

3265,572 in period 3, 26701.74 in period 4, and 51120.33 in period 5. This means that the influence of foreign tourist visits on the number of available rooms increases over time.

Total Guests is an independent variable that shows the number of guests staying in Indonesia. The regression coefficient value for this variable shows how big an influence the number of guests has on the number of rooms available. The regression coefficient value for this variable is 6033,831 in period 1, which means there is a small positive relationship between the number of guests and the number of rooms available in that period. This means that the more guests staying, the more rooms are available. The regression coefficient value for this variable becomes greater in periods 2, 3, 4, and 5, which means the relationship between the number of guests and the number of available rooms becomes greater in these periods. This means that the influence of the number of guests on the number of rooms available increases over time. The regression coefficient value for this variable is 5771.285 in period 2, which increases to 9618.093 in period 3, 45204.80 in period 4, and 26723.12 in period 5. This means that the influence of the number of guests on the number of available rooms is greatest in period 4. Internet User is an independent variable that shows the number of internet users in Indonesia. The regression coefficient value for this variable shows how much influence internet users have on the number of rooms available. The regression coefficient value for this variable is 0 in period 1, which means there is no relationship between internet users and the number of rooms available in that period. The regression coefficient value for this variable becomes positive in periods 2, 3, and 4, which means there is a positive relationship between internet users and the number of rooms available in these periods. This means that the more internet users there are, the more rooms are available. The regression coefficient value for this variable is 4616.540 in period 2, which increases to -10171.27 in period 3, -24940.23 in period 4, and -23056.92 in period 5. This means that the influence of internet users on the number of available rooms fluctuates over time.

Response of Internet User is an analysis that uses the number of internet users in Indonesia as the dependent variable. The regression coefficient value for this variable is constant or intercept, which means the average value of the number of internet users when all independent variables are zero. The regression coefficient value for this variable is 0.893925 in period 1, which decreases to 0.406676 in period 2, and continues to decrease until period 5. This means that the number of internet users tends to decrease over time, but at different rates. Work Participation is an independent variable that shows the level of work participation of the population. The regression coefficient value for this variable shows how much influence work participation has on the number of internet users. The regression coefficient value for this variable is 0.062851 in period 1, which means there is a very small positive relationship between work participation and the number of internet users in that period. This means that the higher the work participation, the more internet users there are. The regression coefficient value for this variable becomes negative in periods 2, 3, 4, and 5, which means there is a negative relationship between work participation and the number of internet users in these periods. This means that the lower the work participation, the fewer internet users. The regression coefficient value for this variable is -0.641786 in period 2, which decreases to -0.996213 in period 3, -1,285,812 in period 4, and -2,022,470.

Table 7. Variance Decomposition

Variance Decomposition Of Work Participation:					
Period	S.E.	Work Participation	Tourism Arrival	Total Guest	Number Of Room
1	0.690373	1.000.000	0.000000	0.000000	0.000000

Period	S.E.	Work Participation	Tourism Arrival	Total Guest	Number Of Room
2	0.812354	9.192.262	2.824.765	1.087.977	3.574.704
3	0.957991	6.678.228	2.153.961	6.174.504	1.873.611
4	1.092.681	5.447.442	1.823.468	8.910.646	2.407.161
5	1.175.831	4.752.338	8.787.410	8.584.669	2.303.003
Variance Decomposition of Tourism Arrival:					
Period	S.E.	Work Participation	Tourism Arrival	Total Guest	Number Of Room
1	938277.5	5.099.143	9.490.086	0.000000	0.000000
2	2503561.	5.911.498	4.015.845	3.269.755	1.436.518
3	4402016.	1.167.261	1.698.141	3.368.312	2.271.067
4	5161501.	9.131.096	2.483.651	2.923.082	2.058.250
5	6515911.	7.550.808	1.979.029	2.707.765	2.446.845
Variance Decomposition Of Total Guest:					
Period	S.E.	Work Participation	Tourism Arrival	Total Guest	Number Of Room
1	16547.73	0.238391	8.270.967	1.705.194	0.000000
2	24985.89	7.288.126	4.866.166	2.406.751	1.395.926
3	38025.83	1.021.691	2.330.369	2.938.782	2.366.932
4	44573.82	8.156.832	2.879.542	2.618.760	2.178.036
5	56092.19	6.917.717	2.434.708	2.506.461	2.445.071
Variance Decomposition Of Number Of Room:					
Period	S.E.	Work Participation	Tourism Arrival	Total Guest	Number Of Room
1	18180.07	2.005.539	0.390198	1.101.527	6.853.915
2	35083.93	6.741.192	6.691.564	5.663.812	1.894.788
3	51008.33	1.603.263	3.206.628	6.234.894	4.087.087
4	92108.82	1.543.044	1.823.778	2.599.820	3.153.138
5	117082.1	1.266.343	3.035.106	2.129.980	2.635.988
Variance Decomposition Of Internet User:					
Period	S.E.	Work Participation	Tourism Arrival	Total Guest	Number Of Room
1	1.220.839	0.265042	3.559.230	3.341.650	9.144.276
2	1.604.472	1.615.331	3.447.615	1.935.164	2.358.189
3	2.260.002	2.757.220	7.577.232	1.040.937	3.424.671
4	3.381.270	2.677.858	1.901.581	9.623.670	3.546.152
5	5.602.855	2.278.281	1.948.872	1.559.168	3.543.103

Variance decomposition is a method for dividing the variation of a variable into components caused by other factors. In the Variance Decomposition of Work Participation, the standard error increases from 0.690373 in period 1 to 1.175831 in period 5, which means that predictions of work participation become increasingly uncertain over time. Work Participation is the proportion of variations in work participation caused by innovation (shock) in work participation itself. This figure shows how much work participation is influenced by internal factors. The larger this number, the stronger work participation is influenced by internal conditions. From table 7 we can see that this proportion decreased from 100% in period 1 to 4.752338% in period 5, which means work participation becomes increasingly influenced by factors other than itself over time.

Tourism Arrival is the proportion of variations in work participation caused by innovation in tourism arrival. This figure shows how much work participation is influenced by the number of tourist visits. The larger this number, the more sensitive work participation is to changes in the

94

number of tourist visits. From table 7 we can see that this proportion increased from 0% in period 1 to 8.787410% in period 5, which means work participation becomes increasingly influenced by tourism arrival over time. Total Guest is the proportion of variations in work participation caused by innovation in total guests. This figure shows how much work participation is influenced by the number of guests staying in tourism accommodation. The larger this number, the more sensitive work participation is to changes in the number of guests staying. From table 7 we can see that this proportion increased from 0% in period 1 to 8.584669% in period 5, which means work participation becomes increasingly influenced by total guests over time. Number of Room is the proportion of variations in work participation caused by innovation in the number of room. This figure shows how much work participation is influenced by the number of rooms available in tourism accommodation. The larger this number, the more sensitive work participation is to changes in the number of rooms available. From table 7 we can see that this proportion increased from 0% in period 1 to 2.303003% in period 5, which means work participation becomes increasingly influenced by the number of rooms over time. In the Variance Decomposition of Tourism Arrivals, the standard error increases from 938277.5 in period 1 to 6515911 in period 5, which means that predictions of tourism arrivals become increasingly uncertain over time. Tourism Arrivals is the proportion of variations in tourism arrivals caused by innovation (shock) in tourism arrival itself. This figure shows how much tourism arrival is influenced by internal factors. The larger this number, the stronger tourism arrivals are influenced by internal conditions. From table 7 we can see that this proportion decreased from 9.490086% in period 1 to 1.979029% in period 5, which means that tourism arrivals become increasingly influenced by factors other than themselves over time.

Work Participation is the proportion of variations in tourism arrivals caused by innovations in work participation. This figure shows how much tourism arrivals are influenced by the percentage of the working population. The larger this number, the more sensitive tourism arrivals are to changes in the percentage of the working population. From table 7 we can see that this proportion varies from 5.099143% in period 1 to 7.550808% in period 5, which means that tourism arrivals are influenced by work participation inconsistently over time. Total Guests is the proportion of variations in tourism arrivals caused by innovation in total guests. This figure shows how much tourism arrival is influenced by the number of guests staying in tourism accommodation. The larger this number, the more sensitive tourism arrivals are to changes in the number of guests staying. From table 7 we can see that this proportion increased from 0% in period 1 to 2.707765% in period 5, which means that tourism arrivals become increasingly influenced by total guests over time. Number of Room is the proportion of variations in tourism arrivals caused by innovation in number of room. This figure shows how much tourism arrival is influenced by the number of rooms available in tourism accommodation. The larger this number, the more sensitive tourism arrivals are to changes in the number of rooms available. From table 7 we can see that this proportion increased from 0% in period 1 to 2.446845% in period 5, which means that tourism arrivals become increasingly influenced by the number of rooms over time. In the Variance Decomposition Of Total Guests, the standard error increases from 16547.73 in period 1 to 56092.19 in period 5, which means that the prediction of total guests becomes more uncertain over time.

Total Guests is the proportion of variations in total guests caused by innovation (shock) in the total guests themselves. This figure shows how much total guests are influenced by internal factors. The larger this number, the more strongly the total guest is influenced by internal conditions. From table 7 we can see that this proportion decreased from 1.705194% in period 1

95

to 2.506461% in period 5, which means that total guests become increasingly influenced by factors other than themselves over time. Work Participation is the proportion of total guest variations caused by innovations in work participation. This figure shows how much total guests are influenced by the percentage of the working population. The larger this number, the more sensitive the total guests are to changes in the percentage of the working population. From table 7 we can see that this proportion varies from 0.238391% in period 1 to 6.917717% in period 5, which means that total guests are influenced by work participation inconsistently over time. Tourism Arrival is the proportion of total guest variations caused by innovation in tourism arrivals. This figure shows how much the total number of guests is influenced by the number of tourist visits. The larger this number, the more sensitive the total guests are to changes in the number of tourist visits. From table 7 we can see that this proportion decreased from 8.270967% in period 1 to 2.434708% in period 5, which means that total guests become less and less influenced by tourism arrivals over time. Number of Rooms is the proportion of total guest variations caused by innovation in number of rooms. This figure shows how much total guests are influenced by the number of rooms available in tourism accommodation. The larger this number, the more sensitive the total guests are to changes in the number of rooms available. From table 7 we can see that this proportion increased from 0% in period 1 to 2.445071% in period 5, which means that total guests become increasingly influenced by the number of rooms over time.

In Variance Decomposition Of Number Of Room, the standard error increases from 18180.07 in period 1 to 117082.1 in period 5, which means that the prediction of number of room becomes increasingly uncertain over time. Number of Room is the proportion of variations in number of room caused by innovation (shock) in the number of room itself. This figure shows how much the number of rooms is influenced by internal factors. The larger this number, the stronger the number of rooms is influenced by internal conditions. From table 7 we can see that this proportion decreased from 6.853915% in period 1 to 2.635988% in period 5, which means that the number of rooms becomes increasingly influenced by factors other than itself over time.Work Participation is the proportion of variations in the number of rooms caused by innovation in work participation. This figure shows how much the number of rooms is influenced by the percentage of the working population. The larger this number, the more sensitive the number of rooms is to changes in the percentage of the working population. From table 7 we can see that this proportion varies from 2.005539% in period 1 to 1.266343% in period 5, which means that the number of rooms is influenced by work participation inconsistently over time. Tourism Arrival is the proportion of variations in the number of rooms caused by innovation in tourism arrivals. This figure shows how much the number of rooms is influenced by the number of tourist visits. The larger this number, the more sensitive the number of rooms is to changes in the number of tourist visits. From table 7 we can see that this proportion decreased from 0.390198% in period 1 to 3.035106% in period 5, which means that the number of rooms becomes less and less influenced by tourism arrivals over time.

Total Guests is the proportion of variations in the number of rooms caused by innovation in total guests. This figure shows how much the number of rooms is influenced by the number of guests staying in tourism accommodation. The larger this number, the more sensitive the number of rooms is to changes in the number of guests staying. From table 7 we can see that this proportion increased from 1.101527% in period 1 to 2.129980% in period 5, which means that the number of rooms becomes increasingly influenced by total guests over time. In the Variance Decomposition Of Internet User, the standard error increases from 1,220,839 in period 1 to

5,602,855 in period 5, which means that internet user predictions become increasingly uncertain over time. Internet Users is the proportion of variations in internet users caused by innovation (shock) in the internet users themselves. This figure shows how much internet users are influenced by internal factors. The larger this number, the stronger the internet user is influenced by internal conditions. From table 7 it can be seen that this proportion decreased from 9,144,276% in period 1 to 3,543,103% in period 5, which means that internet users become increasingly influenced by factors other than themselves over time.

Work Participation is the proportion of variations in internet users caused by innovations in work participation. This figure shows how much internet users are influenced by the percentage of the working population. The larger this number, the more sensitive internet users are to changes in the percentage of the working population. From table 7 we can see that this proportion varies from 0.265042% in period 1 to 2,278,281% in period 5, which means that internet users are influenced by work participation inconsistently all the time. Tourism Arrival is the proportion of variations in internet users caused by innovation in tourism arrivals. This figure shows how much internet users are influenced by the number of tourist visits. The larger this number, the more sensitive the internet user is to changes in the number of tourist visits. From table 7 we can see that this proportion decreased from 3,559,230% in period 1 to 1,948,872% in period 5, which means that internet users become less and less influenced by tourism arrivals over time.

Total Guest is the proportion of variations in internet users caused by innovation in total guests. This figure shows how much internet users are influenced by the number of guests staying in tourism accommodation. The larger this number, the more sensitive the internet user is to changes in the number of guests staying. From table 7 we can see that this proportion increased from 3,341,650% in period 1 to 1,559,168% in period 5, which means that internet users become increasingly influenced by total guests over time. Number of Room is the proportion of variations in internet users caused by innovation in number of room. This figure shows how much internet users are influenced by the number of rooms available in tourism accommodation. The larger this number, the more sensitive the internet user is to changes in the number of available rooms. From table 7 it can be seen that this proportion increased from 2,358,189% in period 2 to 3,546,152% in period 4, but decreased to 2,635,988% in period 5, which means that internet users are influenced by the number of rooms unstable throughout the period. time.

Conclusion

There is a complex and dynamic relationship between work participation, tourist visits, number of guests, number of rooms, and internet users in Indonesia over time. This relationship can be seen from the influence of each variable on other variables. Work participation is negatively correlated with tourist visits, number of guests, and internet users. This shows that the more people work, the fewer people carry out tourism activities and use the internet in Indonesia. However, work participation is positively correlated with the number of rooms. This shows that the more people who work, the more rooms are available in tourism accommodation. Work participation is also influenced by the number of guests and rooms, as well as by the conditions of work participation in the previous period. Tourist visits are positively correlated with the number of guests and number of rooms. This shows that the more people who visit Indonesia, the higher the demand and supply of tourism accommodation in Indonesia. On the other hand, tourist visits are negatively correlated with internet users. This shows that the more people who visit Indonesia, the lower internet access and preference in Indonesia. Tourist visits are also influenced by the number of rooms and internet users, as well as by the conditions of tourist visits in the previous period. The number of guests is positively correlated with the number of

rooms. This shows that the more people who stay overnight in Indonesia, the better the availability and quality of tourism accommodation in Indonesia. However, the number of guests is negatively correlated with internet users. This shows that the more people who stay overnight in Indonesia, the less time and need for internet in Indonesia. The number of guests is also influenced by work participation and tourist visits, as well as by the condition of the number of guests in the previous period. The number of rooms is positively correlated with internet users. This shows that the more rooms available in Indonesia, the better the internet facilities and services in tourism accommodation. In contrast, the number of rooms is negatively correlated with work participation. This shows that the more rooms available in Indonesia, the lower the competition and efficiency of the tourism sector. The number of rooms is also influenced by work participation, tourist visits and the number of guests, as well as by the condition of the number of rooms in the previous period. Internet users are negatively correlated with work participation, tourist visits, and number of guests. This shows that the more internet users there are in Indonesia, the lower the economic activity, tourism and accommodation in Indonesia. Internet users are also influenced by work participation, tourist visits, and number of rooms, as well as by the condition of internet users in the previous period.

Theoretical Contributions
This research provides a deeper understanding of the relationship between variables related to the tourism sector in Indonesia, namely work participation, tourist visits, number of guests, number of rooms, and internet users. This research reveals the existence of a complex and dynamic relationship between these variables, which are influenced by conditions in the previous period and influence each other. This research shows that work participation has a negative correlation with tourist visits, number of guests, and internet users, but a positive correlation with the number of rooms. This shows that there is a trade-off between economic activity and tourism in Indonesia, as well as between the availability of accommodation and competition in the tourism sector. This research shows that tourist visits have a positive correlation with the number of guests and number of rooms, but a negative correlation with internet users. This shows that there is a positive relationship between demand and supply of tourism accommodation in Indonesia, but there is a negative relationship between tourism and internet access and preferences in Indonesia. This research shows that the number of guests has a positive correlation with the number of rooms, but a negative correlation with internet users. This shows that there is a positive relationship between the availability and quality of tourism accommodation in Indonesia, but there is a negative relationship between accommodation and time and internet needs in Indonesia. This research shows that the number of rooms has a positive correlation with internet users, but a negative correlation with work participation. This shows that there is a positive relationship between internet facilities and services in tourism accommodation in Indonesia, but there is a negative relationship between accommodation availability and the efficiency of the tourism sector in Indonesia. This research shows that internet users have a negative correlation with work participation, tourist visits and number of guests. This shows that there is a negative relationship between internet users and economic activity, tourism and accommodation in Indonesia.

Practical Contributions
This research can provide useful information for the government, business actors and the community in formulating policies and strategies related to the tourism sector in Indonesia. This research can provide input for the government in managing resource allocation, incentives and

regulations that can improve the welfare of the community, both those who work in the tourism sector and those who do not. This research can provide input for business actors in developing products and services that suit market needs and preferences, both related to accommodation, transportation, destinations and the internet. This research can provide input for the public in choosing activities and a balanced lifestyle between work, traveling and using the internet, as well as taking advantage of the facilities and services available in the tourism sector in Indonesia.

Policy Advice

The government should encourage productive and flexible work participation, which can balance work and travel, and utilize internet technology to increase efficiency and creativity. Increasing the promotion and diversification of Indonesian tourism, both cultural, natural and religious, by utilizing social media, influencers and digital platforms, as well as developing halal tourism. Increasing internet access and preferences in Indonesia, by expanding internet networks and services, providing digital education and literacy, and integrating the internet with the tourism sector. Increase cooperation and synergy between government, business actors and the community, in developing and managing the tourism sector, as well as overcoming existing challenges and opportunities.

Research Limitations

This research only analyzes the relationship between five variables related to the challenges of industry 4.0 in Indonesia, namely internet users, number of rooms, number of guests, tourist visits, and work participation. Other variables that might influence the challenges of Industry 4.0 are not included in this research. This research uses secondary data from the World Bank and UNWTO for the period 2000-2022. Primary data or data from other sources were not used in this research. Periods shorter or longer than this time span were also not examined in this study. This research uses a vector autoregression (VAR) model to test the relationship between variables. Other models that might be used to analyze the relationship between variables are not compared or discussed in this study. This research was conducted in Indonesia as a case study. Other countries that may face industry 4.0 challenges are not used as comparisons or references in this research.

References

Ben Youssef, A., & Zeqiri, A. (2022). Hospitality industry 4.0 and climate change. Circular Economy and Sustainability, 2(3), 1043-1063.

Ellitan, L. (2020). Competing in the era of industrial revolution 4.0 and society 5.0. Jurnal Maksipreneur: Manajemen, Koperasi, dan Entrepreneurship, 10(1), 1-12.

Garg, A. (2020). Factors influencing generation Y to choose Airbnb. In The Emerald Handbook of ICT in Tourism and Hospitality (pp. 45-65). Emerald Publishing Limited.

Handani, N. D., Riswanto, A. L., & Kim, H. S. (2022). A study of inbound travelers experience and satisfaction at quarantine hotels in Indonesia during the COVID-19 pandemic. information, 13(5), 1-10.

Jan, Z., Ahamed, F., Mayer, W., Patel, N., Grossmann, G., Stumptner, M., & Kuusk, A. (2023). Artificial intelligence for industry 4.0: Systematic review of applications, challenges, and opportunities. Expert Systems with Applications, 216(1), 1-10.

Jayabaya, I. O., Bekti, H., Sumadinata, R. W. S., & Widianingsih, I. (2021). Digital tourism strategy in Indonesia. Vegueta Anuario de La Facultad de Geografía e Historia, 21(2), 58-67.

Margherita, E. G., & Bua, I. (2021). The role of human resource practices for the development of Operator 4.0 in Industry 4.0 organisations: a literature review and a research agenda. Businesses, 1(1), 18-33.

Martín, J. C., Rudchenko, V., & Sánchez-Rebull, M. V. (2020). The role of nationality and hotel class on guests' satisfaction. A fuzzy-topsis approach applied in saint petersburg. Administrative Sciences, 10(3), 1-10.

Molino, M., Cortese, C. G., & Ghislieri, C. (2020). The promotion of technology acceptance and work engagement in industry 4.0: From personal resources to information and training. International journal of environmental research and public health, 17(7), 2438.

Narayan, R., Gehlot, A., Singh, R., Akram, S. V., Priyadarshi, N., & Twala, B. (2022). Hospitality Feedback System 4.0: Digitalization of Feedback System with Integration of Industry 4.0 Enabling Technologies. Sustainability, 14(19), 1-10.

Nhamo, G., Nhemachena, C., & Nhamo, S. (2020). Using ICT indicators to measure readiness of countries to implement Industry 4.0 and the SDGs. Environmental Economics and Policy Studies, 22(2), 315-337.

Pencarelli, T. (2020). The digital revolution in the travel and tourism industry. Information Technology & Tourism, 22(3), 455-476.

Priyambudi, S., & Murdani, M. H. (2020). The Development of E-Learning Model for College Students in the Industrial Era 4.0. Journal of Education and Practice, 11(31), 68-78.

Rahmayani, D., Oktavilia, S., Suseno, D. A., Isnaini, E. L., & Supriyadi, A. (2022). Tourism Development and Economic Growth: An Empirical Investigation for Indonesia. Economics Development Analysis Journal, 11(1), 1-11.

Ramos, C. M., & Brito, I. S. (2020). The effects of industry 4.0 in tourism and hospitality and future trends in Portugal. In The Emerald Handbook of ICT in Tourism and Hospitality (pp. 367-378). Emerald Publishing Limited.

Streimikiene, D., Svagzdiene, B., Jasinskas, E., & Simanavicius, A. (2021). Sustainable tourism development and competitiveness: The systematic literature review. Sustainable development, 29(1), 259-271.

Tortorella, G., Miorando, R., Caiado, R., Nascimento, D., & Portioli Staudacher, A. (2021). The mediating effect of employees' involvement on the relationship between Industry 4.0 and operational performance improvement. Total Quality Management & Business Excellence, 32(1-2), 119-133.

Toubes, D. R., Araújo Vila, N., & Fraiz Brea, J. A. (2021). Changes in consumption patterns and tourist promotion after the COVID-19 pandemic. Journal of Theoretical and Applied Electronic Commerce Research, 16(5), 1332-1352.

Widarni,E.L, Prestianawati,S.A, & Bawono,S.(2020).Digital economy challenge: Innovation of technology and unemployment dilemma in Indonesia.The Future Opportunities and Challenges of Business in Digital Era 4.0 (page 167-170). London : Routledge

Widiastuti, I. A. M. S., Astawa, I. N. D., Mantra, I. B. N., & Susanti, P. H. (2021). The Roles of English in the Development of Tourism and Economy in Indonesia. SOSHUM: Jurnal Sosial Dan Humaniora, 11(3), 305-313.

Yuliani, E. (2024). The effects of the Indonesian conditional cash transfer program on transition out of agriculture. World Development, 173(1), 1-10.

Zeqiri, A., Dahmani, M., & Youssef, A. B. (2020). Digitalization of the tourism industry: What are the impacts of the new wave of technologies. Balkan economic review, 2(1), 63-82.