Readiness To Face Industry 4.0

by Siti Maria

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Readiness To Face Industry 4.0

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Abstract: The study aimed to analyze the influence of economic, social, cultural, technological, and environmental dimensions on the readiness of PT. Jatim Watkoraya (Samarinda Branch) in the face of Industry 4.0. Based on the formulation, objectives, relationships between variables, to the hypothesis proposed, the data is processed using the Partial Lest Square (PLS) model and the SmartPLS 3.0 program. Based on the type of research that is descriptive and verification, the research method used is explanatory survey at PT. Jatim Watkoraya (Samarinda Branch) as many as 36 respondent. The results of the study state that Economic Dimension and Environmental Dimension have a positive and significant effect on Readiness to Face Industry 4.0. Cultural Dimensions and Technology Dimensions have a positive but not significant effect on Readiness to Face Industry Industry 4.0. The Social Dimension has a negative and not significant effect on Readiness to Face Industry 4.0. The industrial revolution cannot only be faced with technological development, without involving economic, social, cultural and environmental dynamics in it.

Index Terms: Economic; Social; Cultural; Technological; Environmental dimension; Industry 4.0

1 INTRODUCTION

The history of the industrial revolution starts from industry 1.0, 2.0, 3.0, to industry 4.0. The industrial phase is a real change of changes. Industry 1.0 is characterized by the mechanization of production to support the effectiveness and efficiency of human activities, industry 2.0 is characterized by mass production and quality standardization, industry 3.0 is characterized by mass adjustment and flexibility of automation-based manufacturing and robots. Industry 4.0 then replaces industry 3.0 which is characterized by cyber physical and manufacturing collaboration [1,2]. The term industry 4.0 comes from a project initiated by the German government to promote computerization of manufacturing. The industry 4.0 was characterized by an increase in digitalization of manufacturing driven by four factors: (1) increased data volume, computing power, and connectivity; (2) the emergence of analysis, capability and business intelligence; (3) the occurrence of new forms of interaction between humans and machines; and (4) improving digital transfer instructions to the physical world, such as robotics and 3D printing [3]. The basic principle of industry 4.0 is the integration of machines, workflows, and systems, by applying intelligent networks along the chain and the production process to control each other independently [4]. The Industrial Revolution 4.0 was a big challenge for the country of Indonesia. Advances in technology that move very quickly through speed in accessing the internet have a major influence in accessing the latest information more quickly. The influence of the industrial revolution was explained at The World Economic Forum (WEF), which stated that the industrial revolution 4.0 was characterized by technological fusion that was able to replace the human resources, production tools, and operational methods to achieve a goal, which at present known as the era of disruption [5]. To address this challenge, Indonesia needs to increase and strengthen its potential, especially in the field of creative industries. The creative economy contributed 7.44% to the total Indonesian economy. Culinary (41.40%), fashion (18.01%), and craft (15.40%) are the 3 highest fields in the GDP contribution of the creative economy sub-sector [6]. Samarinda City which is the capital of East Kalimantan Province, has a population of 843,446 people (growth rate of 1.83%), with a density of 1,177 people per km^2 in 2017. Samarinda has a population the biggest compared to other Cities and Regencies in East Kalimantan. Of these, most of them are immigrants, so the mobility of people coming out and entering Samarinda is huge and it is only natural that many companies engaged in the trade sector (small, medium to large scale) are opening branches or opening companies in that field [7]. One of the trading sections is PT. Jatim Watkoraya (Samarinda Branch). The high demand for household goods, particularly the fulfillment of the field of home hardware, such as lights, cables, switch outlets, decorative lights, and so on, makes this company have a large interest (from inside and outside the city). Expansion of goods production and rising household consumption, is a challenge for PT. Jatim Watkoraya to evaluate all aspects, both economically and non-economically, so that customer satisfaction can be fulfilled.

Improvements in external factors such as market share, competition between companies engaged in the same field, to revitalize the internal parts of PT. Jatim Watkoraya through improving the quality of human resources is a great homework, so that the company's existence continues. Advanced technology with different variations of goods at each time, cannot be avoided along with the intensity of consumer demand, so that the quality improvement of employees at PT. Jatim Watkoraya (Samarinda Branch). Human resources are crucial as the main indicators in production inputs, in addition to management, capital, location, company performance, and other factors. Changes in the world are now entering the era of industrial revolution 4.0 or where information technology has become the basis of human life. Everything becomes limitless with unlimited use of computing power and data, because it is influenced by the

development of massive internet and digital technology as the backbone of the movement and connectivity of humans and machines. This era will also disrupt various human activities, the problem of human resources is an important element in the organization. Human resources play a role in determining the direction and progress of an organization, such as PT. Jatim Watkoraya. Based on the background and description, the purpose of this study is to analyze the influence of economic, social, cultural, technological, and environmental dimensions on the readiness of PT. Jatim Watkoraya (Samarinda Branch) in the face of Industry 4.0.

2 METHODOLOGY

Research uses associative analysis with quantitative methods, namely the type of research that tests the causal relationship between two or more variables. Latent variable (exogenous construct) which is determined is Economic, Social, Cultural, Technological, and Environmental Dimension. Whereas, latent variables (endogenous constructs) are determined namely is Readiness to Face Industry 4.0, and manifest (observed) variables consisting of: (1) Production Efficiency and Effectiveness; (2) Economic Valuation System; (3) Employee Welfare: (4) Expansion of Employment; (5) Employee Skills; (6) Human Resources Based on Soft Skills; (7) Human Resource Development; (8) Capability and Capacity; (9) Personal Characteristics; (10) Organizational Culture; (11) Access to the Broad World; (12) Freedom of Opinion; (13) Cultural Background Integration; (14) Digitizing Technology; (15) Connectivity of Production Machines; (16) Speed of Technology; (17) Environmentally Friendly Technology; (18) Environmental Externalities; (19) Work Environment Support; (20) Technical Assistance; (21) Decentralized Decisions; (22) Interconnection; and (23) Information Transparency. To facilitate a study departing and boils down to a clear goal, then the research was simplified into variable buildings [8]. That a variable is an attribute or characteristic of an object or activity that has certain variations set by the researcher to study and draw conclusions [9]. Based on the formulation, objectives, the relationship between the research model and the hypothesis proposed, the data is processed using the Partial Lest Square (PLS) model. The purpose of PLS is to test weak theories and weak data such as small number of samples or the existence of data normality problems, predict the influence of variable X (exogenous variable) on Y (endogenous variables) and explain the theoretical relationship between the two variables [10]. Based on the type of research that is descriptive and verification, the research method used is explanatory survey. Determination of primary data based data sources obtained through interview respondents directly through questionnaires in the field. Based on research needs, because the population is less than 100 respondents, the researchers took 100% of the population at PT. Jatim Watokoraya (Samarinda Branch) as many as 36 people. Thus, the use of the entire population without having to draw the research sample as an observation unit is referred to as the census technique [11]. Analysis of structural models on PLS, carried out with 3 stages: (1) Analysis of the outer model; (2) Analysis of inner models; and (3) Hypothesis testing. Outer model analysis is done to ensure that the measurements used are feasible to be used as measurements (valid and reliable). Outer model analysis can be seen from several indicators: (1) Convergent validity, (2) Discriminant validity, and (3) Unidimensionality.

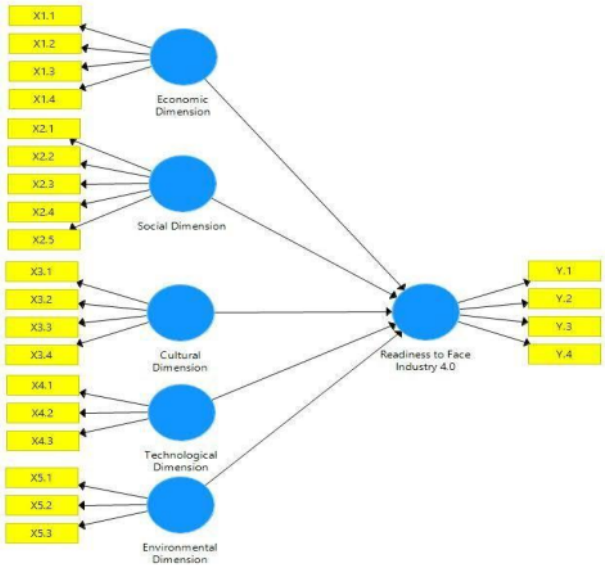

Figure 1: Construction of Research

To test the hypothesis, it is done by looking at the probability values and t-statistics. For probability values, the p-value with alpha 5% is less than 0.05. The t-table value for alpha 5% is 1.96. So, the hypothesis acceptance criteria are when t-statistics > t-table. Meanwhile, the analysis of the inner model/structural analysis of the model is carried out to ensure that the structural models are robust and accurate. Evaluation of the inner model can be seen from several indicators which include: (1) The coefficient of determination (R^2); (2) Predictive relevance (Q^2); and (3) Goodness of Fit Index (GoF). The structural model testing of PLS can be done with the help of the SmartPLS Program version 3.0 for Windows through 2 tested models, namely the measurement model (outer model) and the inner model. The complete structural model can be examined in the following Figure 1.

3 RESULTS

Outer models can be interpreted by looking at some coverage, including: Convergent Validity, Discriminant Validity, Composite Reliability, Average Variance Extracted (AVE), Alpha Cronbach's, and Outer Collinearity Statistics (VIF). The PLS Algorithm model can be presented in Figure 2.

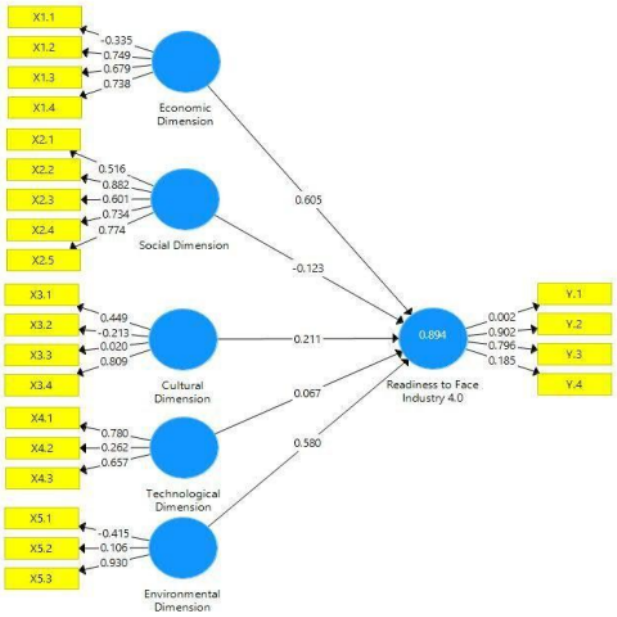

Figure 2: PLS Algorithm Model

First, is the convergent value that is in order to measure the magnitude of the loading factor on each latent variable. Loading Factor above 0.70 is highly recommended. However, the size above 0.60 can be tolerated as long as the research model is in the development stage. The output that explains the relationship between latent variables and indicators is as follows:

Table 1: Outer Model (Loading Indicator)

	X1	X2	X3	X4	X5	Y
X1.1	-0.335					
X1.2	0.749					
X1.3	0.679					
X1.4	0.738					
X2.1		0.516				
X2.2		0.882				
X2.3		0.601				
X2.4		0.734				
X2.5		0.774				
X3.1			0.449			
X3.2			-0.213			
X3.3			0.020			
X3.4			0.809			
X4.1				0.780		
X4.2				0.262		
X4.3				0.657		
X5.1					-0.415	
X5.2					0.106	
X5.3					0.930	
Y.1						0.002
Y.2						0.902
Y.3						0.796
Y.4						0.185

Source: SmartPLS 3.0 Output (2019)

Second, the discriminant value is useful to assess whether the variable has adequate discriminant validity by comparing the indicator correlation with the intended construct must be greater than the correlation with the other constructs. If the correlation of the indicator has a higher value than the indicator correlation in other constructs, it is said that the variable has high discriminant validity. This value can be seen in the value of the data validity test or cross loading factor. The results of the complete data validity test are as follows:

Table 2: Test Validity of Data (Cross Loading)

	X1	X2	X3	X4	X5	Y
X1.1	-0.335	-0.160	-0.323	-0.231	-0.260	-0.537
X1.2	0.749	0.404	-0.222	0.156	0.185	0.472
X1.3	0.679	0.161	-0.266	-0.088	-0.032	0.260
X1.4	0.738	0.538	0.251	0.239	0.163	0.426
X2.1	0.448	0.516	0.428	0.399	0.241	0.498
X2.2	0.456	0.882	0.640	0.554	0.412	0.633
X2.3	0.192	0.601	0.344	0.007	0.295	0.253
X2.4	0.472	0.734	0.204	0.276	0.678	0.648
X2.5	0.225	0.774	0.531	0.572	0.672	0.495
X3.1	0.197	0.299	0.449	0.357	-0.038	0.151
X3.2	0.236	0.118	-0.213	0.407	-0.084	-0.114
X3.3	0.089	0.198	0.020	0.243	0.016	-0.069
X3.4	0.126	0.607	0.809	0.446	0.317	0.305
X4.1	0.410	0.454	-0.063	0.780	0.242	0.294
X4.2	0.016	-0.051	0.323	0.262	-0.137	0.043
X4.3	-0.065	0.374	0.673	0.657	0.073	0.233
X5.1	0.053	-0.122	-0.380	0.322	-0.415	-0.261
X5.2	0.254	0.223	-0.172	0.226	0.106	0.232
X5.3	0.250	0.634	0.244	0.285	0.930	0.656
Y.1	0.046	0.102	-0.148	0.087	-0.131	0.002
Y.2	0.608	0.796	0.514	0.431	0.737	0.902
Y.3	0.624	0.456	0.069	0.210	0.551	0.796
Y.4	0.342	0.158	0.206	-0.105	-0.115	0.185

Source: SmartPLS 3.0 Output (2019)

In Table 2, in broad outline there are 20 indicators that are consistent and the value is higher to the intended construct variable. The indicators based on each contract are the Economic Valuation System (X1.2) to the construct of Economic Dimension with a loading of 0.749, Human Resources Based on Soft Skills (X2.2) to the Social Dimension construct of 0.882, an indicator of Cultural Background Integration (X3. 4) towards the construct of Cultural Dimension of 0.809, Digitizing Technology (X4.1) to Tehcnological Dimension is 0.780, Work Environment Support (X5.3) to Environmental Dimensin 0.930, and Decentralized Decisions (Y.2) to Readiness to Face Industry 4.0 of 0.902. Likewise for other indicators, there are 3 indicators namely: Production Efficiency and Effectiveness (X1.1), Access to the Broad World (X3.2), and Environmentally Friendly Technology (X5.1) having the lowest loading value (negative) to the respective constructs that are addressed. *Third*, high composite reliability values indicate good consistency of each indicator in latent variables to measure these variables. Criteria for composite reliability values > 0.7 indicate that these variables have good internal consistency. The full composite reliability value is presented below:

Table 3: Value of Composite Reliability

Construct	Composite Reliability
Economic Dimension (X1)	0.591
Social Dimension (X2)	0.834
Cultural Dimension (X3)	0.268
Technological Dimension (X4)	0.604
Environmental Dimension (X5)	0.165
Readiness to Face Industri 4.0 (Y)	0.585

Source: SmartPLS 3.0 Output (2019)

The highest composite reliability value is 0.834 (Social Dimension). whereas, there are 5 constructs with composite reliability values below 0.07, then these variables do not have good internal consistency. *Fourth*, Average Variance Extracted (AVE) shows the variance value of each indicator in the construct that can be captured by these variables more than the variance caused by measurement errors. Expected AVE value > 0.5. The following is the AVE result in the SmartPLS output:

Table 4: AVE Value

Construct	AVE
Economic Dimension (X1)	0.420
Social Dimension (X2)	0.509
Cultural Dimension (X3)	0.225
Technological Dimension (X4)	0.370
Environmental Dimension (X5)	0.349
Readiness to Face Industri 4.0 (Y)	0.370

Source: SmartPLS 3.0 Output (2019)

The biggest AVE value is the construct of Social Dimension. Therefore, the other five construct variables (Economic Dimension, Cultural Dimension, Technological Dimension, Environmental Dimension, and Readiness to Face Industry 4.0) with values below 0.5 or are said to be inappropriate based on statistical criteria. *Fifth*, the reliability test of the research model was strengthened with alpha cronbach's score. The limit of alpha cronbach's reliability test is > 0.7. The results of the reliability test of the PLS model are:

Table 5: Cronbach's Alpha Value

Construct	Cronbach's Alpha
Economic Dimension (X1)	0.716
Social Dimension (X2)	0.748
Cultural Dimension (X3)	0.454
Technological Dimension (X4)	0.254
Environmental Dimension (X5)	0.084
Readiness to Face Industri 4.0 (Y)	0.477

Source: SmartPLS 3.0 Output (2019)

The reliability results of the cronbach's alpha value from Economic Dimension and Social Dimension are 0.716 and 0.748. Meanwhile, 4 other variables prove negative and below 0.7. The meaning of these values are the constructs of Cultural Dimension, Technological Dimension, Environmental Dimension, and Readiness to Face Industry 4.0 which have been shown to lack accuracy, consistency, and inaccuracy in measuring the construct (see Table 5).

Table 6: Outer Collinearity Statistics (VIF) Value

Indicator	VIF
Production Efficiency and Effectiveness (X1.1)	1.114
Economic Valuation System (X1.2)	3.414
Employee Welfare (X1.3)	3.551
Expansion of Employment (X1.4)	1.335
Employee Skills (X2.1)	1.261
Human Resources Based on Soft Skills (X2.2)	2.930
Human Resource Development (X2.3)	1.978
Capability and Capacity (X2.4)	1.721
Personal Characteristics (X2.5)	2.108
Organizational Culture (X3.1)	1.184
Access to the Broad World (X3.2)	1.183
Freedom of Opinion (X3.3)	1.296
Cultural Background Integration (X3.4)	1.079
Digitizing Technology (X4.1)	1.003
Connectivity of Production Machines (X4.2)	1.060
Speed of Technology (X4.3)	1.062
Environmentally Friendly Technology (X5.1)	1.211
Environmental Externalities (X5.2)	1.167
Work Environment Support (X5.3)	1.044
Technical Assistance (Y.1)	1.424
Decentralized Decisions (Y.2)	1.491
Interconnection (Y.3)	1.435
Information Transparency (Y.4)	1.431

Source: SmartPLS 3.0 Output (2019)

Sixth, for the multicollinearity test can see the output results through the Collinearity Statistic Variance Inflation Factor (VIF), the VIF value must be < 10 or < 5. Below are the statistics from VIF [12]. From Table 6, it is known that all indicators have a VIF value of < 10, so that it can be concluded that for each of these variables it represents no multicollinearity. Inner model or structural analysis of the model is carried out to ensure that the structural models are robust and accurate. Evaluation of inner model can be seen from several indicators which include: Determination Coefficient (R2), Predictive Relevance, and Goodness of Fit Index (GoF), and Outer Collinearity Statistics (VIF). The output of SmartPLS based on the inner model criteria is described in the following section. *First*, the results of the coefficient of determination from Readiness to Face Industri 4.0 obtained the R2 value of 0.894, which can be interpreted that the variant on Readiness to Face Industri 4.0 can be explained by the construct of Economic Dimension, Social Dimension, Cultural Dimension, Technological Dimension, Environmental Dimension is 89.4%. Meanwhile, the remainder of 0.106 or 10.6% (1 - 0.894) is explained by other variables other than those studied (Table 7).

Table 7: R Square

Variable	R Square	R Square Adjusted
Y	0.894	0.877

Source: SmartPLS 3.0 Output (2019)

Effect size (f square) needs to be done to find out the goodness of this research model. Based on Table 8, the f^2 value of the Readiness to Face Industry 4.0 variable supported by the constructs of Social Dimension, Cultural Dimension, and Technological Dimension is categorized as having a weak influence by predictive latent variables at the structural level. Meanwhile, the f^2 value of the variable supported by the construct of Economic Dimension (2.107) and Environmental Dimension (1.497) is categorized as a very strong influence of exogenous latent variables at the structural level.

Table 8: f Square

Construct	Y
Economic Dimension (X1)	2.107
Social Dimension (X2)	0.028
Cultural Dimension (X3)	0.226
Technological Dimension (X4)	0.027
Environmental Dimension (X5)	1.497

Source: SmartPLS 3.0 Output (2019)

Second, the magnitude of Q-Square predictive relevance for the structural model, measures how well the observation value is generated by the model and also its parameter estimates. Q-square value > 0 indicates the model has the opposite predictive relevance if the Q-square value ≤ 0 indicates the model lacks predictive relevance. Q-Square value has the same meaning as determination coefficient (R-Square) in PLS analysis, where the higher the Q-Square, the model can be said to be better or more fit with the data. The results of calculating the Q-Square value are as follows:

Q-Square = 1 – [(1 – R21) x (1 – R22)]
= 1 – [(1 – 0.894) x (1 – 0.894)]
= 1 – (0.106 x 0.106)
= 1 – 0.011
= 0.989

Based on the results of the above calculations, obtained the Q-Square value of 0.989. This shows the magnitude of the diversity of the research data that can be explained by the research model is 98.9%. Meanwhile, the remaining 0.011 or 1.1% is explained by other factors that are outside the research model. Thus, from these results, this research model can be stated to have good goodness of fit. *Third*, is to look for the value of Goodness of Fit (GoF). GFI describes the level of suitability of the overall model calculated from the residual square of the predicted model compared to the actual data. Unlike CBSEM, for GoF on PLS-SEM it must be searched manually. This GoF value is obtained from the square root of the average communalities index multiplied by the average value of the R^2 model. Here are the calculations:

$$\text{GoF} = \sqrt{\overline{AVE} \times \overline{R^2}}$$
$$= \sqrt{0.374 \times 0.894}$$
$$= \sqrt{0.334}$$
$$= 0.578$$

Referring to the calculation above, the GoF value is 0.578. These results are used to validate the combined performance between the measurement model (outer model) and the structural model (inner model) which extends between 0 - 1, with an interpretation of that value > 0.36 (large GoF).

Table 9: Inner Collinearity Statistics (VIF) Value

Variable	VIF
Economic Dimension (X1)	1.641
Social Dimension (X2)	5.105
Cultural Dimension (X3)	1.864
Technological Dimension (X4)	1.564
Environmental Dimension (X5)	2.121

Source: SmartPLS 3.0 Output (2019)

Fourth, [12] suggests that PLS theory excludes Ordinal Least Square (OLS) assumptions such as data that are normally distributed in a multivariate manner and there are no multicollinearity problems between exogenous variables. The Table 9 illustrates the value of the collinearity statistic (VIF) of the inner model. For the Economic Dimension, Social Dimension, Cultural Dimension, Technological Dimension, Environmental Dimension variables, both Readiness to Face Industri 4.0 together achieve similar results with inner VIF values under 10 and represents no multicollinearity due to the VIF criteria < 10.

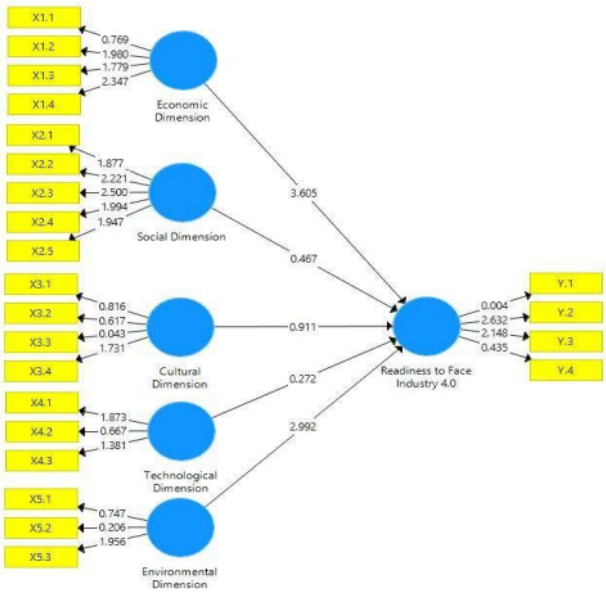

Figure 3: Bootsrapping Result

The next test is to see the significance of each influence between exogenous constructs to endogenous and answer what has been formulated and hypothesized. The testing of the significance level is 0.05 or 5%, if the t-statistic value is > 1.96, then the hypothesis is acceptable. The value of the t-

statistic of the effect coefficient of the latent construct is obtained through PLS Bootstrapping. The results of the model are presented in Figure 3.

Table 10: Highlights of the Coefficient and Probability Value

Inflence	Original Sample (O)	T Statistics (|O/STDEV|)	P Values	Hypothesis
X1 -> Y	0.605	3.609	0.000	Accepted
X1 -> Y	-0.123	0.481	0.631	Rejected
X3 -> Y	0.211	0.894	0.372	Rejected
X4 -> Y	0.067	0.271	0.787	Rejected
X5 -> Y	0.580	3.055	0.002	Accepted

Source: SmartPLS 3.0 Output (2019)

The parameter coefficient value can be seen in the original sample and p-values summarized in Table 10.

4 CONCLUSIONS

Referring to the results of the analysis, then conclusions can be taken are: (1) Economic Dimension and Environmental Dimension have a positive and significant effect on Readiness to Face Industry 4.0; (2) Cultural Dimension and Technological Dimension have a positive but not significant effect on Readiness to Face Industry 4.0; and (3) Social Dimension have a negative and not significant effect on Readiness to Face Industry 4.0. The problems that occur today, cannot be solved in the same way as in the past concept. The industrial revolution 4.0 cannot only be faced with technological development, without involving economic, social, cultural and environmental dynamics in it. In addition to preparing superior competitiveness, PT. Jatim Watkoraya (Samarinda Branch) needs to build awareness and maturity of employee resources in addressing the development of the world today, especially in the age of post truth, when information flows profusely without clarity of truth. It is necessary to formulate the company's internal policy strategy through awareness and maturity of thinking. In the face of the 4.0 industrial revolution, the researchers argue that there are two paths that are taken though: (1) PT. Jatim Watkoraya (Samarinda Branch) prepares the implementation of a program based on a link and match between human resources and current needs; and (2) Revitalizing the company's human resources through human values that are taught by the social humanities role. When the exact sciences play a role in the development of empirical technology, the science still plays a role in maintaining human quality (software/users). If this happens, the advancement of technology as a biological child can have a positive impact on the sustainability of the company, workers, and the surrounding environment.

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