

**The effects of big data analytics, digital learning orientation on the innovative work behavior****Mas Achmad Daniri<sup>a</sup>, Sugeng Wahyudi<sup>\*</sup> and Irene Demi Pangestuti<sup>a</sup>**<sup>a</sup>*Universitas Diponegoro, Semarang, Indonesia***CHRONICLE***Article history:*

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*Keywords:**Big data analytics**Digital learning orientation**Environmental strategy**Readiness for change**Innovative work behavior***ABSTRACT**

Previous studies have argued that increasing knowledge capacity in big data analytics influences increasing the speed of information processing and network analysis for making the right decisions at scale and high volume. Big data intensification supported by knowledge capacity through digital learning and a strategically supportive environment can ultimately help companies improve company performance. This study seeks to analyze the effect of big data analytics, digital learning orientation and environmental strategy on readiness for change and innovative behavior. The sampling technique employed by using simple random sampling on 185 respondents of information technology companies. By using the Structural Equation Modeling (SEM) analysis technique with the Partial Least Square approach, the empirical results show that big data analytics, digital learning orientation and environmental strategy had a significant effect on readiness for change and positively influence innovative work behavior. The analysis of mediation through the variable of readiness to change also found the role of mediation in strengthening the influence of exogenous variables on innovative work behavior. These results theoretically reveal the important role of data-driven performance management as an instrumental consequence. Practically speaking, the findings highlight the importance of employee engagement and talent acquisition professionals as a driving force in the intensification of big data analytics.

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**1. Introduction**

Organizations in the technological advancement of the industrial revolution 4.0 are faced with the challenge of digital learning orientation which can blur assumptions about work done by humans and that done by machines. Therefore, innovative work behavior in organizations or companies is needed in this era. Through this framework, the entire process of changing information can occur between humans and humans, humans and objects and between objects themselves (Ślusarczyk, 2018). One of the technologies that companies need to accelerate information processing and information analysis is big data. Big data is one of the approaches used to manage and analyze data using five main dimensions, namely volume, variety, velocity, veracity and value (Wamba et al., 2016). Big data also has the ability to process both structured and unstructured data (Ahmed et al., 2017). Some of the uses of Big data include to analyze public responses to existing products and services through sentiment analysis, a basis for decision-making, managing brand image, business planning and market trends. Utilization of big data is supported by increased speed of information processing and analysis of information on a large volume scale (Saggi & Jain, 2018). This information is also targeted for companies so that they can reach the appropriate consumer segments. It was then directed to influence consumers in obtaining satisfaction with products or services and bring transformation in understanding changing consumer needs. The scope of big data is known as the 3V which consists of: volume of information, velocity or

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speed of data collection which is offset by the rapid growth in the amount of data, and variety or coverage that can be reached (Buhl et al., 2013).

Manyika et al. (2011) stated that big data analytics is a crucial point in an information-rich era in driving productivity, competition and innovation. Furthermore, Abbasi et al. (2016) stated that big data analytics plays an instrumental role in avoiding bias in corporate decision making, and provides data-based empirical evidence. Some companies today are increasingly relying on big data analytics for consumer data analysis and information processing and networks as a basis for real-time decision making. Big data analytics also plays a role as a provider of organizational initiatives in future strategy and innovation (Constantiou & Kallinikos, 2015; Liu, 2014; Ransbotham & Kiron, 2017). Afifa & Nguyen (2022) also found that big data analytics along with digital learning orientation and environmental strategy have an effect on organizational performance. Aboobaker & Zakkariya (2021) found that digital learning orientation influences readiness for change and innovative behavior. This underlines the important role of talented employees in the configuration of the relationship between data analytics and innovation. Several studies have also found an important role for environmental strategy in the form of workplace digitalization in driving innovation and readiness for change (Hooi & Chan, 2022; Pot et al., 2017; Stofberg et al., 2021). This means, organizations need the support of several complementary resources to enable the use of big data analytics as a source of strategic decision making. Thus, the necessary combination reflects strategic developments in digital, human, financial, and environmental learning to create big data analytics capabilities in readiness for innovative work behavior changes. The purpose of this research is to analyze the effect of big data analytics, digital learning orientation, and environmental strategies on innovative work behavior mediated by readiness to change in information technology organizations and companies in Indonesia.

## 2. Literature Review and Hypotheses

### 2.1. *Big Data Analytics, Readiness for Change and Innovative Work Behavior*

Big data has been used in many companies to assist companies in analyzing what strategies need to be carried out in making decisions so that they are right on target. Mikalef et al. (2017) defines big data analytics as a technology designed to extract economic value from large amounts of diverse data, by enabling high-speed capture, discovery, and/or analysis. In utilizing big data, companies should be able to combine the amount of big data they have with high-powered analytics, companies can complete business-related work such as strategic decision making within the company produce more specific and precise information; and re-weigh all risks in a short time. Optimizing the use of hardware and software solutions to lighten the workload is one of the fundamental initiatives to handle big data and information processing as a strategic part of organizational goals. Companies can integrate several variations of raw data and analyze this data then produce real-time decisions that reflect consumer demand and market segment trends (Brynjolfsson & Saunders, 2009). Berner et al. (2014) emphasized the need for organizations to adapt the use of large-scale data analysis to become a raw material for innovation. Strategically, big data analytics can provide access to a broad and diverse collection of interrelated information to improve decision-making accuracy and employee readiness for change (Shah et al., 2017; Kalema & Mokgadi, 2017). Von Hippel & Cann (2021) indicate that the factors of readiness for change in using big data analytics technology have a mutually bound and inseparable relationship in realizing innovative work behavior. This showed that as part of the company's change process, big data analysis can provide new depth and insight to explore innovative employee attitudes and behavior in supporting organizational change (Eby et al., 2000; Elias, 2009). In the relationship between big data analytics and innovation, previous findings (Gupta & George, 2016; Wamba et al., 2017) stated that there was an empirical relationship, where a positive relationship was found between big data analytics on innovative work behavior. Lehrer et al. (2018) also found that big data analytics has a significant influence on innovation behavior. Chen et al. (2012) found that big data analytics can enable organizations to better understand large-scale data configurations to generate crucial insights needed for designing corporate strategies based on the competitive environment and consumer demands or market trends. Therefore, the hypotheses can be formulated as follows:

**H<sub>1</sub>:** *Big data analytics has a significant effect on readiness for change.*

**H<sub>2</sub>:** *There is a significant influence of big data analytics on innovative work behavior.*

### 2.2. *Digital Learning Orientation, Readiness for Change and Innovative Work Behavior*

With a digital learning orientation to get used to working systems using technology, readiness to change is needed in dealing with any changes that occur in an organization or company. Oreg et al. (2011) showed that readiness of employees was dealing with a change in the organization. The most important factor is the readiness factor as the employee's initial support in the initiative to make changes (Holt et al., 2007). Three concepts that explain readiness to change include: self-readiness to change; readiness of the organization in managing any changes that occur; readiness of the organization in implementing these changes (Zhou et al., 2005). An employee's readiness to change has an important role in determining the success or failure of the digital learning orientation process. If the employee has mature readiness in using the technology used in the company, in

this case, big data analytics, then the employee is easily able to carry out innovative work behavior related to the work being done. Conversely, the lower level of employee readiness to make changes will be more likely to reduce the applicability of big data analytics technology and reduce innovativeness in implementing this technology in organizational works (Aboobaker & Zakkariya, 2021). Innovation is largely driven by individual readiness or attitudes towards change, which refers to the cognitive precursor behavior of rejecting or supporting change efforts to accepting the application of technology in their work systems (Dunham et al., 1989). Budhiraja (2019) identified that personal or individual factors of employees and organizations or companies related to leadership style, supervisory support, self-efficacy, personal valance, work characteristics and organizational or corporate culture have an impact on individual readiness to make changes.

The digital learning orientation is very supportive in creating changes in employee work behavior that are more innovative. With a digital learning orientation, employees in a company are expected to be able and ready to always explore new technologies used in the company to improve company performance. Digital learning orientation provides great benefits for companies where when the application of digital learning orientation to employees is successful, innovative changes in work behavior can be achieved (Choi, 2007). To maximize the application of digital learning orientation, it is necessary to support the readiness of organizations or companies to use digital devices, which in this case is big data analytics. Tan et al. (2021) revealed that the digital learning orientation showed a positive response in its readiness to be able to change innovative work behavior. These findings can serve as a reference that can be used by companies to apply a digital learning orientation in developing and planning strategies to increase the level of professionalism and to realize innovative work behavior.

**H<sub>3</sub>:** *Digital learning orientation has a significant effect on readiness for change.*

**H<sub>4</sub>:** *There is a significant influence of digital learning orientation on innovative work behavior.*

### 2.3. *Environmental strategy, readiness to change and innovative work behavior*

Environmental strategy is a form of communication process in technology acquisition from one party to another where there is a technological gap between one environment and another. This transfer will affect the company's capability in achieving efficiency and effectiveness by acquiring technology in the company's work system (Jamil et al., 2015). In order to encourage business sustainability, support from an Environmental strategy, management understanding and entrepreneurship is needed, accompanied by a series of collaborative systems and media that bridge the existence and development of technology, management, entrepreneurship, growth and development of companies (Manu & Sriram, 1996). The success of an Environmental strategy requires many factors, especially a high level of commitment and funding for a common goal (Bozeman, 2000; Manu & Sriram, 1996).

Environmental strategies that provide competitive advantage are described as future orientation, application of technology or adaptation of products and processes, as well as management systems and business strategies (Aragón-Correa, 1998; Hart, 1995; Russo & Fouts, 1997; Marcus & Geffen, 1998; Christmann, 2000). Changes in this environmental strategy can be a source of problems if the company is late in adapting and taking the right strategic steps. Companies that are able to adapt in a sustainable manner to the changing demands of the business environment will advance and develop. Conversely, organizations that are unable to adapt to changes in the environmental strategy will experience setbacks, even bankruptcy (Ancok, 2012). Environmental strategy in the company also influences the creativity generated by the employees. The environmental strategy is embedded with employees so that it cannot be separated from efforts to develop innovative work behavior by employees. In addition to the environmental strategy factor, motivational factors are also related to creating creative ideas. Such conditions are influential in arousing, directing and maintaining behavior related to environmental strategy. Walls et al. (2011) empirically proved that the variable of work motivation is related to the work innovativeness of employees.

**H<sub>5</sub>:** *Environmental strategy has a significant effect on Readiness for Change.*

**H<sub>6</sub>:** *There is a significant influence of Environmental strategy on Innovative Work Behavior.*

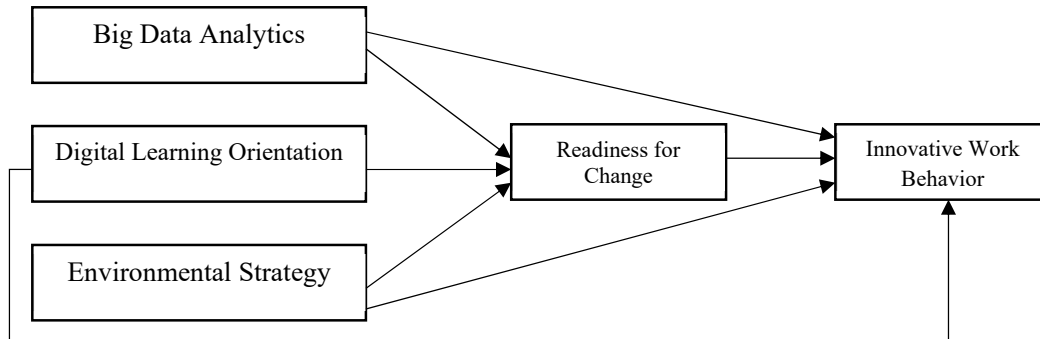
### 2.4. *Mediating Effects of Readiness for Change*

In the context of readiness for change that aims to be innovative in work behavior, Baker & Sinkula (1999) showed that employees of an organization who have a readiness for mature change are more prepared to demonstrate innovative work behavior with a work system. adopting technology. This will encourage open-mindedness and encourage internal stakeholders to and assist their company's employees in adopting new technologies and developing new skills, as well as designing more innovative products (Quinton et al., 2018). In the research of Aboobaker & Zakkariya (2019) and Vey et al. (2017) have identified that personal/individual traits and contextual factors have a significant influence on individual readiness to change. The direct relationship between individual readiness to change is convincing and persuasive, with readiness to change being a cognitive trait that will enhance innovative work behavior.

Innovative work behavior involves employees at all levels in changing the way an organization manages, regulates, implements technology and other resources related to the company's work cycle (Totterdill & Exton, 2014). Ramamoorthy et al. (2005) and Belloc (2012), comprehensively explain the determinants of innovative work behavior within an organization or company. The findings from this study explain that innovative work behavior at the company level seems to be related to a combination of three types of factors, namely: organizational factors; work group factor; and individual factors. Innovative work behavior in using technology in this case is big data analytics can be increased with the same two competencies needed for knowledge innovation plus the ability to process big data analytics. So that with the right skills and competencies for an employee to work in an innovative manner, it will improve the quality of the employee's work which will also have an impact on the company's work system (Asensio-López et al., 2019). Thus, this study proposes the following hypotheses:

**H<sub>7</sub>:** *Readiness for Change has a significant effect on Innovative Work Behavior.*

**H<sub>8</sub>:** *Readiness for Change mediates the effect of big data analytics, digital learning orientation and environmental strategy on Innovative Work Behavior.*



**Fig. 1.** Theoretical Framework

### 3. Research Method

The method used in this research is to use quantitative research methods. The design used in this study is a causality descriptive research design. The variables used in this study are big data analytics, digital learning orientation and environmental strategy as exogenous variables, while readiness for change and innovative work behavior are endogenous variables. The research was conducted by distributing questionnaires with a five-point Likert scale directly to the respondents. Then the questionnaire was distributed to be filled in by respondents with each answer separately. The sample selection technique used is non-probability sampling, this sampling technique does not provide equal opportunities for each member of the population to be selected as a sample. In this study, a sample of 185 respondents was taken from companies in Indonesia where these companies already use big data analytics technology in their work systems. To test the hypothesis proposed in this study, the analysis technique used is SEM (Structural Equation Modeling) which is operated through the AMOS program.

### 4. Empirical Results

In determining the results of the analysis in this study, the convergent validity was required with the standard loading factor value for each indicator of more than 0.6. The results of the validity test of this study are presented in Table 1. To test convergent validity, this study employs the Average Variance Extracted (AVE) value with a minimum limit of 0.5 to show that the items used are valid. The results as presented in Table 2 obtained an Average Variance Extracted (AVE) of Big Data Analytics of 0.828, Digital Learning Orientation of 0.803, Environmental Strategy of 0.833, Readiness for Change of 0.809, and Innovative Work Behavior of 0.599. This showed that all items for all constructs examined in this study are valid. The next test is Discriminant Validity, with the results as in Table 3. The results of this analysis strengthen the validity test for all items and constructs in this study. The results confirm that all the variables examined in this study are valid, so that further tests can be processed. Furthermore, the reliability test is carried out by determining the value of Composite Reliability and Cronbach's Alpha for all constructs. By using the minimum limit of Cronbach's Alpha of 0.6, the test results show that all variables in this study are reliable, which is indicated by the value of Cronbach's Alpha of Big Data Analytics of 0.958 (C.R 0.966), Digital Learning Orientation of 0.951 (C.R 0.961), Environmental strategy of 0.960 (C.R of 0.968), Readiness for Change of 0.953 (C.R of 0.962), and Innovative Work Behavior of 0.868 (C.R of 0.900).

**Table 1**  
Results of Outer Loading

Items	Big Data Analytics	Digital Learning Orientation	Environmental strategy	Readiness for Change	Innovative Work Behavior
BDA1	0.899				
BDA2	0.920				
BDA3	0.919				
BDA4	0.913				
BDA5	0.906				
BDA6	0.901				
DLO1		0.882			
DLO2		0.885			
DLO3		0.909			
DLO4		0.901			
DLO5		0.897			
DLO6		0.902			
ES1			0.892		
ES2			0.913		
ES3			0.912		
ES4			0.921		
ES5			0.922		
ES6			0.915		
RC1				0.908	
RC2				0.920	
RC3				0.916	
RC4				0.895	
RC5				0.904	
RC6				0.852	
IWB1					0.750
IWB2					0.797
IWB3					0.771
IWB4					0.785
IWB5					0.746
IWB6					0.794

**Table 2**  
Convergent validity

Variables	External loading factors	AVE
Big Data Analytics	0.899-0.920	0.828
Digital Learning Orientation	0.882-0.909	0.803
Environmental strategy	0.892-0.922	0.833
Readiness for Change	0.852-0.920	0.809
Innovative Work Behavior	0.746-0.797	0.599

**Table 3**  
Discriminant Validity

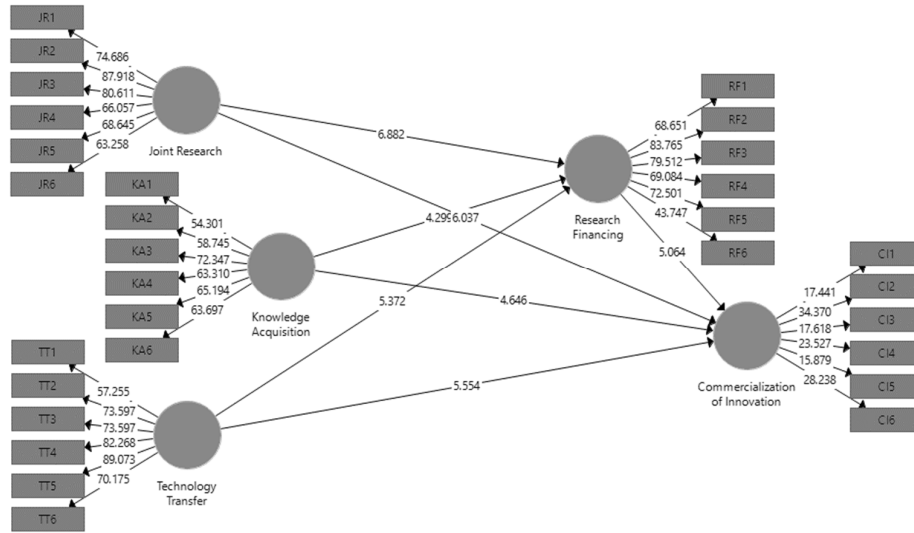
Variables	IWB	BDA	DLO	RC	ES
IWB	0.774				
BDA	0.822	0.910			
DLO	0.784	0.691	0.896		
RC	0.835	0.759	0.711	0.900	
ES	0.793	0.663	0.665	0.730	0.912

IWB= Innovative Work Behavior; BDA= Big Data Analytics; DLO= Digital Learning Orientation; ES= Environmental strategy; RC= Readiness for Change

**Table 4**  
Composite Reliability and Cronbach's Alpha

Variables	Cronbach's Alpha	Composite Reliability
Big Data Analytics	0.958	0.966
Digital Learning Orientation	0.951	0.961
Environmental strategy	0.960	0.968
Readiness for Change	0.953	0.962
Innovative Work Behavior	0.868	0.900

In testing the variability of the constructs in Partial Least Squares (PLS), the study used R-Square ( $R^2$ ) and Path Coefficient (PC). Testing the inner model of the structural model is carried out by looking at the  $R^2$  value in the endogenous latent construct and the t value of each exogenous latent variable in the endogenous latent construct from the bootstrapping results (Fig. 2).



**Fig. 2.** Bootstrapping's results

Empirical analysis as shown in Table 5 shows the adjusted R-square value of Readiness for Change is 0.686 or 68.6%. Furthermore, the adjusted R-Square for innovative work behavior was 0.839 or 83.9 percent. It means that its variability was determined by readiness for change, big data analytics, digital learning orientation, and environmental strategy variables.

**Table 5**  
Adjusted R-Square

Endogenous variables	R Square	R Square Adjusted
Readiness for Change	0.691	0.686
Innovative Work Behavior	0.842	0.839

Hypothesis testing was then performed to analyze the effect of Big Data Analytics on Readiness for Change (Table 6). The results found a significant effect of big data analytics on readiness for change. This was indicated by T-stat. of 6.882 and a p value of  $0.000 < 0.50$ . Thus, the first hypothesis stated that big data analytics has an effect on readiness for change was accepted. The results are consistent with previous findings demonstrating that the utilization of Big Data Analytics is more likely to increase employee readiness for change (Shah et al., 2017; Kalema & Mokgadi, 2017; Von Hippel & Cann, 2021). Furthermore, statistical output also showed a significant effect of Big Data Analytics on Innovative Work Behavior with T-stat. of 6.037 and significance level of 0.000. Thus, the second hypothesis which stated that Big Data Analytics significantly influences Innovative Work Behavior was accepted. This means that big data analytics has a positive role in improving employee innovative work behavior. The findings are supported by empirical evidence revealed by previous findings, highlighting a significant effect of big data analytics and innovative work behavior (Gupta & George, 2016; Wamba et al., 2017; Lehrer et al., 2018; Chen et al., 2012).

In examining the effect of Digital Learning Orientation on Readiness for Change, the results showed a significant effect, indicated by T-stat. of 4.299 and significance value of 0.000. This means that the third hypothesis stating that Digital Learning Orientation has a significant effect on Readiness for Change was accepted. This empirically proves that the more the digital

learning orientation, the more the Readiness for Change of employees. The results are in line with previous research demonstrating the positive relationship between Digital Learning Orientation on Readiness for Change (Aboobaker & Zakkariya, 2020). The fourth hypothesis stated that Digital Learning Orientation has a significant influence on Innovative Work Behavior. The findings showed that this hypothesis was accepted, with T-stat. of 4.646 and a p value of 0.000 <0.50. This means that digital learning orientation is more likely to enhance Innovative Work Behavior of employees. The findings are consistent with Atitumpong & Badir (2018), Tan et al. (2021) stating a significance effect of Digital Learning Orientation on Innovative Work Behavior.

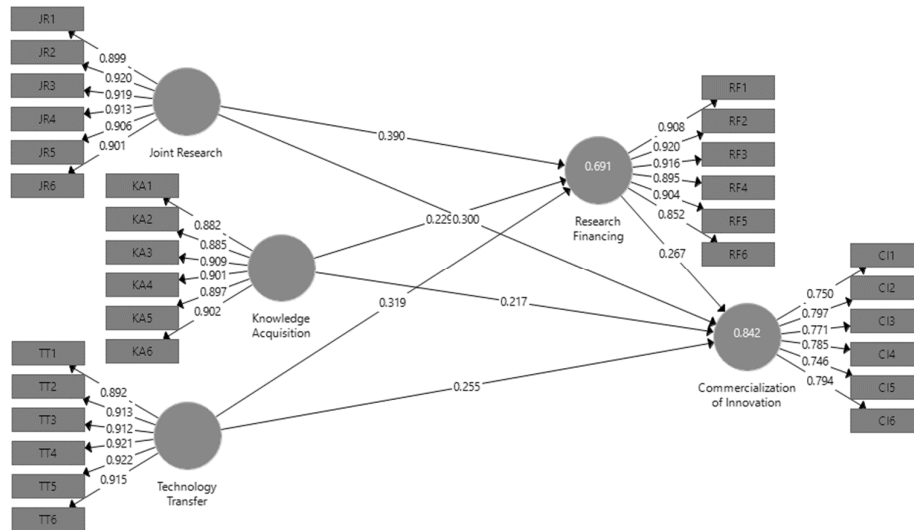


Fig. 2. Result analysis of research model

Empirical evidence showed the effect of Environmental Strategy on Readiness for Change. The results show a significance value with the T-stat. of 5.372 and a p value of 0.000 <0.50. This means that there is a significant impact of Environmental Strategy on Readiness for Change. Thus, the fifth hypothesis stating that Environmental Strategy has a significant effect on Readiness for Change was declared accepted. The results are in line with previous research. Arham et al. (2020) stating that rapid development of technology should be anticipated by business people to remain competitive (Arham et al., 2020). The findings are also consistent with Stofberg et al. (2021) stating that environmental support systems in digitalization will be more likely to help the employee readiness for change. Moreover, in examining the effect of Environmental strategy on Innovative Work Behavior, statistical output showed a significance value of 5.554 and p-value of 0.000 <0.50. Thus, the sixth hypothesis which stated that Environmental strategy influences Innovative Work Behavior was accepted. The findings are consistent with Walls et al. (2011), Stofberg et al. (2021) empirically proving that the variable of workplace support is related to the work innovativeness of employees.

Table 6

Path Coefficient

Path	T-stat.	P-value
H1 Big Data Analytics → Readiness for Change	6.882	0.000
H2 Big Data Analytics → Innovative Work Behavior	6.037	0.000
H3 Digital Learning Orientation → Readiness for Change	4.299	0.000
H4 Digital Learning Orientation → Innovative Work Behavior	4.646	0.000
H5 Environmental Strategy → Readiness for Change	5.372	0.000
H6 Environmental Strategy → Innovative Work Behavior	5.554	0.000
H7 Readiness for Change → Innovative Work Behavior	5.064	0.000

The results also revealed a significant effect in the relationship between Readiness for Change and Innovative Work Behavior. The findings obtained T-stat. of 5.064 and p-value of 0.00. Thus, the seventh hypothesis stating that Readiness for Change significantly influences Innovative Work Behavior is accepted. This suggests that Readiness for Change is a fundamental basis of innovativeness for companies to create competitive advantage in exploring the utilization of big data analytics.

**Table 7****Specific Indirect Effect Result**

Path relationships	T-stat.	Pvalue
Big Data Analytics → Readiness for Change → Innovative Work Behavior	4.365	0.000
Digital Learning Orientation → Readiness for Change → Innovative Work Behavior	3.100	0.002
Environmental strategy → Readiness for Change → Innovative Work Behavior	3.737	0.000

In testing the mediating effect, the hypothesis testing as shown in Table 7 revealed that the mediating variable of Readiness for Change is empirically proven to mediate the effect of Big Data Analytics → Readiness for Change → Innovative Work Behavior with T-stat of 4.365 and p-value of 0.000; Digital Learning Orientation → Readiness for Change → Innovative Work Behavior with T-stat of 3.100 and p-value of 0.002; and, Environmental strategy → Readiness for Change → Innovative Work Behavior with T-stat. of 3.737 and p-value of 0.000. This means that readiness for change is able to enhance individual outcomes in corporate employees in creating innovative work behaviors. In organizational or corporate settings, previous studies have found that resources are more likely able to improve employee performance, through the mediating effect of readiness for change (Jia al., 2019; Katsaros et al., 2020). In general, the findings confirm previous research showing that big data analytics enables companies to be more proactive and faster in identifying new business opportunities (Liu (2014). It is also more likely to improve new products and services in innovative work behavior (Ransbotham & Kiron, 2017). Likewise, Gupta & George (2016), Wamba et al. (2017), Constantiou & Kallinikos (2015) found that big data is a necessary resource for organizations to create value keep up with the rapid expansion of volume, speed, and variety of data to gain insights in driving productivity, competition and innovation (Mikalef et al. (2017).

## 5. Conclusion

Empirical analysis shows that big data the empirical results showed that big data analytics, digital learning orientation and environmental strategy have a significant effect on readiness for change and positively influence innovative work behavior. The analysis of mediation through the variable of readiness to change also found the role of mediation in strengthening the influence of exogenous variables on innovative work behavior. The results theoretically reveal the important role of data-driven performance management as an instrumental consequence. Practically speaking, the findings highlight the importance of employee engagement and talent acquisition professionals as a driving force in the intensification of big data analytics.

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