Digital Literacy and its Relationship with Employee Performance in the 4IR

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Abstract **- Work in the oil and gas industry today in general has rapidly grow alongside with the advancement of digital technology. However, many employees are facing issues of coping and keeping up with the technological knowledge in completing their work. This study investigates the relationship between digital literacy and employee performance in the oil and gas industry in Malaysia. The technological, organizational and environmental (TOE) context was applied to measure the influencing factors. Stratified sampling method was used to attain information from two divisions of the organization. Data was analyzed using correlational analysis and multiple regression methods. Outcome of this study suggests that there is a positive relationship between digital literacy in technological context, organizational context, environmental context and employee performance. It is suggested that a good foundation in the technological and organizational infrastructure is needed to increase digital literacy among employees. For future research, readiness in embracing digital literacy should be made at the managerial level in this industry.**

Keywords: Digital literacy, technological context, organizational context, environmental context, employee's performance.

I. Introduction

The Industrial Revolution 4.0 (4IR) is here and it has been dubbed as a new disruptor in technological tools and software cropping out within the industrial world to develop users' perspectives with latest gadget and ways of doing things, however, less thought was made to involve the adult novice digital skills. Business leaders around the globe are on the cliff's edge when they realized how digital phenomena could change the way their industries work (Huyler & Ciocca, 2015). Huyler and Ciocca research revealed that the capability of the people to a new change is very low, especially among the baby boomers. According to the World Economic Forum report, "The Future of Jobs" released in January 2016, five million jobs in the world's leading economies could disappear over the next five years due to redundancy and automation. Advancement in technology such as Artificial Intelligence, Robotics, and Biotechnology will cause disruption to business models and labour markets over the next five years, (Schwab, 2016). The highly dynamic and competitive working environment of the twenty-first century demands more innovative and flexible approach. An important distinction in today's working world relies on applied technology and digital communities, (Bynghall, 2016). However, employees in the oil and gas industry are facing issues such as lack of technological knowledge in doing their work.

Digital workforce has been the hives of many these days, especially for those who wish to sound like up-to-date trendsetter, Hunt & Miller, (2015). Therefore, it is interesting to know the extent of digital literacy in corporate workforce embracing the new environment ever since the introduction of Malaysia Multimedia Super Corridor (MSC) in 1996 with the adoption of a knowledge-based society framework (Saad, 2008), and the progressiveness of the vision set back two decades ago to have positive relationship toward the improvement of the corporate performance in the private sector in Malaysia. Past research suggests that competitive intensity plays a crucial role in determining organizational performance (Abubakar, Kura & Ringim, 2018).

Based on the tradition in Malaysian education, there is lack of direct participation of users in information systems design as opposed to traditional, engineering-oriented systems designs. While much of the approach was initially prescriptive, with the more grounded on empirical studies, the digital literacy education design

concept is also evolving to accommodate this change, which is more in line with the critical education approach that was adopted in this study. Jalil and Kamaruddin (2018) in their research mentioned though rapid economic growth has positive outcome for developing countries whereby the government manages to generate more national income.

II. Background of Study

Digital technology allows people to interact and communicate with family and friends on a regular basis even though with the "busy constraints" of today's world, Rubble & Bailey, (2007). Digital literacy literally means a set of competencies required for inclusion in a knowledge society. It comprises of knowledge, skills and behaviors concerning the effective use of digital devices such as smartphones, tablets, laptops and desktop PCs for determinations of collaboration, communication, and advocacy. The focus has shifted from stand-alone computers to data link-up devices including the Internet and social media. Paul Gilster (1977) in his book, had simplified digital literacy as the usage and comprehension of information in the digital age, with emphasized on the importance of digital technologies as an "essential life skill."

A digitally literate individual will retain a range of digital skills, knowledge in principles of computing devices, and skills in using computer networks. The individual is capable to engage in online communities and social networks while observing to behavioral protocols. That will allow the individual to evaluate information, perform logical analysis and capture value added solutions. Individuals need to understand the issues within the society elevated by digital technologies and own critical thinking skills. Pushing through multitude of media platforms will enable individual to gain digital experiences to enable them thinking in a variety of ways.

In reality, most organizations are only at the very start of thinking and acting holistically about their digital workforce. For example, a survey of Digital Workplace Group in United Kingdom members at the end of 2015 established that less than a quarter had a formal digital workforce program or function in place (Bynghall, 2016).

The real problems are in defining a digital workforce strategy, roadmap or service components as the most commonly mentioned strategic objective amongst the government and corporate alike. The need for data, moving forward with the digital workforce agenda within any organization is not necessarily straightforward. There may be a lack of consensus among stakeholders about how to proceed, as well as no objective or independent data about the organization's digital workforce.

Major global corporations and government sector are getting on the digital workforce fever. Malaysia has created a new hype around the term and business organization are also actively engaging around the topic. Malaysia Digital Economy Corporation (MDEC) is currently responsible to ensure that Malaysians play an integral part in developing and nurturing talent to drive digital innovation around the digital world, while attracting participation from global ICT companies to invest and develop cutting edge digital and a creative solutions.

Substantial change is predicted in the skill sets needed to thrive in a new Digital Economy. Shifting organizational and learning culture is unavoidable, and with such predictions, governments around the world, including Malaysia, have begun incorporating digital-based education within school curriculums, Colbert, Yee, & George (2016).

By identifying the gap and success factor of digital literacy within this GLC Oil & Gas corporation work culture, proper program and learning packages can be developed to fulfil the requirement and to ensure minimal disruption on the vision of going for complete digital workforce in the near future.

Technological, Organizational and Environmental (TOE)

The technological, organizational and environmental (TOE) context was used in this study and related methodologies in provided a snapshot of particular benefits of digital literacies in employee's performance as well as obstacles and problems with acquiring digital skills. TOE set the context of the digital literacy of these individual within the oil and gas organization provided a platform for the other organization to discuss and arrive at some conclusions as to what would help them.

The technological context comprised of two factors that could potentially have an impact on the IT decision makers' intent to adopt cloud computing. The two factors were relative advantage and compatibility. Organizational context comprised organizational size, top management support, and organizational readiness. Environmental context in this study comprised coercive pressures (pressures that come from customers), mimetic pressures (pressures that come from competitors), and normative pressures (pressures that come from

trade associations). As discussed in Section 1, several prior studies have suggested that these factors have been found to be significant determinants in influencing IT decision makers' intent in adopting new technologies (Messerschmidt & Hinz, 2013).

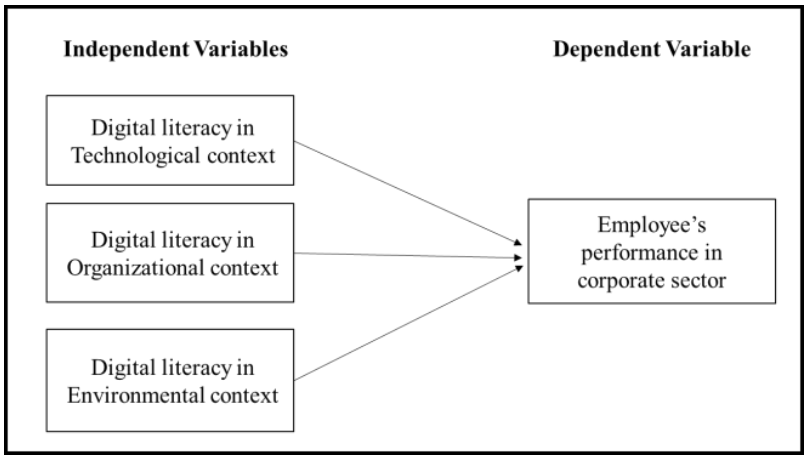

Figure 1 - Research framework based on digital literacy in TOE context and employee performance.

The study done by Moore & Piwek (2017), lay out the conceptual issues arising alongside the rise of sensory technologies in workforces designed to improve wellness and productivity. The paper indicates that scholars will need to put ethical issues at the heart of research on sensory tracking technologies in workforces that aim to regulate employee behavior via wellness initiatives and explores the legal issues around data protection and potential work intensification.

Some scholars explore the complexity of digital technologies in changing how workers connect with their co-workers in the organization while examines to what extent digital technologies are changing the ways work gets done. It lingers in the thought on how digital technologies drive engagement and what are the HR's role in stewarding the work of enabler for digital engagement in the modern workforce, Jesuthasan (2017).

In another insight, a study on how company's digital experience affect the employees' performance conducted by Raia (2017), explains that a good digital experience will motivate the employees to use the new approach, else it will becomes a disaster to the company, no matter how important and how big the investment was.

The significant experience explored by Trautrims, Defee, & Farris, (2016), examine the use and effects of global virtual teams as a tool in the logistics and supply chain management classroom to prepare students in a simulation environment for the demands of their future careers in the profession.

Another research done in United States of America stated that there is a significant positive relationship between groups tested on valence and perceived usefulness to accept technology change in the workforce, (West, 2016). Finally, in discussing the digital literacy and its relationship towards employee performance, there is a need to understand the established workforce measurements available.

III. Methodology

A quantitative method with a descriptive correlational design was used for the study. Quantifying relationships between variables was what quantitative research is all about (Hopkins, 2000). The purpose of this non-experimental, quantitative study was to determine the correlation between one or more independent variable and the outcome or dependent variable in a sample test, sanctioning the significant relationship between the diffusion of digital literacy using TOE context and performance among the employees of an oil and gas company

The research method is designed to determine the correlation between the technological, organizational, and environmental factors in an oil and gas corporation in which the organization having intention to adopt digital workforce. A cross-sectional survey, hosted by multi discipline mode was applied, to collect data related to the Research Questions from the survey participants, and used both inferential and descriptive statistics to examine the multi-survey data.

IV. Findings

A total of three hundred and fifty-nine (359) sets of questionnaires was distributed and two hundred and ninety-four (294) responses finally collected (82%). Out of them, fifteen (15) responses were filtered out due to incompleteness and missing information. The remaining total number of two hundred and seventy-nine (279) records or seventy-eight percent (78%) of the intended population were used for the actual data analysis. The respondent distribution was, 119 male and 160 female, with age range for majority of the respondents were 25 to 34 years old, with distribution of 106 (38%), 62 (22.2%) were from those less than 25 years old, 57 (20.4%) were age 35-44 years old and 48 (17.2%) were between 45-54 years, leaving 6 respondents (2.2%) with those age more than 55 years old.

4.1 Factor Analysis of Digital Literacy and its Relationship with Employee: Application of TOE Theory

Conducting factor analysis can produce a sense of surprise to express judgment regarding the dimensions underlying constructs. The results of factor analysis will confirm whether or not the theories meet the intended dimension and hypotheses, Sekaran & Bougie (2010). Researcher intention was to establish a measure to test both consistency and stability of the data, it will set the underlying factors that sum up the important information within the variables, Coakes & Ong (2011).

Igbaria et. al (1995) describes items that loads greater than (.60) under one component and loads lower than (.35) under the other components should be group into same component items. However, item which has a factor loading lower than (.60) under all components should be dropped from further analysis.

The protocol adopted here for factor analysis was to use default settings initially (Principal Component Analysis - PCA) and to rotate the matrix of loadings to obtain orthogonal (independent) factors (Varimax rotation with Kaiser Normalization). The prime goal of factor analysis was to identity simple items loadings (> .30 on only one factor) that are interpretable, assuming that items are factorable. The Kaiser-Meyer-Olkin measure of sampling adequacy test whether the partial correlations among variables are small. Bartlett's tests of sphericity test whether the correlation matrix is an identity matrix, indicating if the factor model is inappropriate or otherwise.

Once clearly defined and interpretable factors had been identified and responses related to these factors were saved in the form of factor scores, these Bartlett factor scores corresponding to sub-scale or scale scores with means of zero and standard deviations of one (z-scores), and with participants credited with separate scores in relation to each identified factor.

Table 1: Analysis on Digital Literacy and its Relationship with Employee Perfomance

Factor(s) / Item(s)	**Mean**	**Std. Deviation (SD)**
Independent Variable (IV) Factor 1: Digital literacy in technological context.		
1. I know different types and medium of information technology gadgets/devices to perform my task.	4.49	.599
2. I know what my 'digital tools' needed for operating, i.e. what happens to personal computer configuration to be operational.	4.51	.548
3. I know what latest digital technology I can use on the enterprise network and workplace.	4.50	.610
4. I can choose the right tool and application to find, use or operate the right information devices to perform better.	4.60	.531
5. I can integrate and connect mobile devices and applications with my office assets to perform my daily task.	4.56	.636

Factor(s) / Item(s)	Mean	Std. Deviation (SD)
Independent Variable (IV) Factor 1: Digital literacy in technological context.		
6. I know to differentiate different protocol and languages commonly used in information search for my discipline.	4.41	.622
7. I understand how to keep digital information secure, e.g. creating secure passwords or online accounts.	4.55	.620
8. I can use scanning/skimming techniques to quickly access the key relevant information on a web page.	4.49	.610
9. I can use media-capture devices to record and edit a podcast or video.	4.59	.505
10. I know the company is implementing new technologies to support and enable work activities in a rapid innovation and delivering more integrated customer experiences.	4.52	.535
Cronbach Alpha	.969	
Cronbach's Alpha if Item Deleted	(.989)	
Independent Variable (IV) Factor 2: Digital literacy in organizational context.		
1. I can add comments to blogs, forums or web pages, observing 'netiquette' and appropriate social conventions for online communications.	4.42	.569
2. I can use other people's work (found online) without committing plagiarism.	4.41	.605
3. I can add comments to blogs, forums or web pages, observing 'netiquette' and appropriate social conventions for online communications.	4.30	.663
4. I can share files legally with others.	4.44	.637
5. I can create content online for different audiences using the appropriate style or tone, a presentation for use by my fellow employees.	4.30	.663
6. I can interact with others online (forums, blogs, social networking sites, audio, video, etc.)	4.45	.632
7. I can collaborate safely with others online to create a shared document or presentation.	4.60	.498
8. I know how to establish who owns information and ideas I find online and use it legally.	4.53	.514
Cronbach Alpha	.791	
Cronbach's Alpha if Item Deleted	(.986)	
Independent Variable (IV) Factor 3: Digital literacy in environmental context.		

1.	I know when I need to change my search strategy and when to perform strategic analysis from big data.	4.58	.502
2.	I know the leader works to communicate their digital agenda and contribute to its evolution.	4.42	.569
3.	I can assess whether an online resource (e.g. web page, blog, wiki, video, podcast, academic journal article) or person is credible and trustworthy	4.41	.605
4.	I can keep a digital record of the relevant information I find online adhering to credible company policy.	4.29	.668
5.	I know how to use reliable social networks to find information to support my job.	4.44	.637
6.	I know how to find and communicate with a person online, e.g. an expert in my chosen discipline, and how to establish their contact details.	4.30	.663
7.	I know how to establish the contact details of an organization I find online.	4.45	.632
8.	I know digital literacy concept encompass learning, critical thinking, and interpretative skills across and beyond professional boundaries.	4.60	.498
	Cronbach Alpha	.782	
	Cronbach's Alpha if Item Deleted	(.985)	
	Dependent Variable (DV) Factor 4: Digital literacy and Employees Performance.		
1.	I understand the need for my department team members to be digitally literate and adding values to the economy.	4.62	.502
2.	I understand my organization's digital direction, my department's digital goals, and my role in reaching these goals.	4.58	.502
3.	I understand specifically what my manager expects of me on digital literacy.	4.42	.569
4.	I understand how well I am doing with digital literacy compared with the expectations.	4.42	.594
5.	I understand what I have to do to improve my digital literacy for job performance.	4.32	.647
6.	I have the digital supplies and digital resources to do my work, or I understand why I don't have them.	4.46	.627
7.	I understand that the company benefited from my participation in the digital transformation.	4.32	.642
8.	I understand that the changes in digital policies, procedures, and equipment introduced by the management, often lead to better ways of doing things.	4.47	.598
	Cronbach Alpha	.969	
	Cronbach's Alpha if Item Deleted	(.990)	

The above result was after data screening and cleaning were conducted, reducing the errors and violation of the assumption tested by running the descriptive statistics analysis. An alpha level of .05 or .01 was generally used in social sciences, as the level of significance representing the 95% and 99% confidence level respectively, Pallant (2005). Cronbach's alpha measurement used as the popular measure for reliability, with (.60) or higher for a component reveals the measuring items under that particular component provides a reliable measure of internal consistency.

The study objective was to confirm if there is a relationship between the independent variables and the dependent variable stated, with element in the influencing factors consist of technological, organizational and environmental context component.

Out of the ten questionnaires on technological context of digital literacy, highest given mean was 4.60 with SD = .531 indicated that the employees are highly aware of the technological important in adopting digital literacy, with high disperse value of SD. On the other hand, lowest mean= 4.41, SD = .622 also indicates employees also aware that they need to secure their password properly by the digital literacy in technological context. Therefore, there is a significant relationship between digital literacy in technological context in improving the employee performance.

Similar to digital literacy in technological context, since the variance in above Table 2.0 with highest and lowest mean is not so significance as all of the responses recorded above 4 (Agree) value, and since SD value illustrated huge dispersible number, it can be concluded that majority of the corporation employees agree that digital literacy in organizational context too had significant impact on the employee performance.

Again, as both digital literacy in technological context and organizational context, variance in environmental context having small difference in highest and lowest mean and indicated not so significance as all of the responses recorded above 4 (Agree) value, also SD value illustrated huge dispersible number, and it can be concluded that majority of the corporation employees agrees that digital literacy in environmental context too had significant impact on the employee's performance.

Table 2: Multiple Regression Analysis Results

	Model	**Unstandardized Coefficients**		**Standardized Coefficients**	**t**	**Sig.**
		β	Std. Error	β		
1	Technological	.934	.014	.969	65.584	.000
2	Organizational	.934	.014	.969	65.584	.000
3	Environmental	1.128	.054	.782	20.850	.000
4	Performance	1.084	.019	.961	57.687	.000

Dependent Variable = Digital literacy towards employee's performance
**Significance level, $p \leq 0.05$

The unstandardized beta (β) represents the slope of the line between the predictor variable (IV) and the dependent variable (DV). This mean for every unit increase in IV, the DV increases by equal unit. The unstandardized beta (SE β), similar to the standard deviation for a mean. The larger the number, the less likely that significance will be found.

For Technological variable, this would mean that for every unit increase in digital literacy of technological content, the dependent variable i.e. employee's performance increases by .934 units. The standard error for the unstandardized beta (SE B). This value is similar to the standard deviation for a mean. The larger the number, the more spread out the points are from the regression line. The more spread out the numbers are, the less likely that significance will be found.

The standardized beta (β), works very similarly to a correlation coefficient. It will range from 0 to 1 or 0 to -1, depending on the direction of the relationship. The closer the value is to 1 or -1, the stronger the relationship. With this symbol, comparison was made on the variables to see which had the strongest relationship with the dependent variable, since Technological data was .969, and on the 0 to 1 scale. From the table above, digital literacy in technological context had a strong relationship.

The t-test statistic (t) is calculated for the individual predictor variable. The probability level (p) value, tells whether or not an individual variable significantly predicts the dependent variable. The study can have a significant model, but a non-significant predictor variable.

Digital literacy for organizational context R=.969 which also indicate high degree of correlation with the employee's performance. R2=.939 or 93.9% of total variation can be explained for the dependent variable (DV) on independent variable (IV or predictor) of digital literacy in organizational context, also a large variation. The SE β = .014, meaning the smaller the number, more likely hood more significance found. The standardized beta (β)= .969, on the 0 to 1 scale, which indicated a very strong relationship.

Thus, digital literacy in organizational context had a strong relationship with the employee's performance. In the end, as much anticipated analysis, the study was to predict the relationship between digital literacy, by combining all the mean between technological context, organizational context and environmental context in relation to employee's performance. Interesting finding resulted whereby, statistically the relationship was also very strong.

The age of respondent being below 35 years old were the highest group. Majority of respondent were bachelor graduate, as it is the minimum requirement for the executive entry level. Most of the respondent are executives, new and old. The organization is having 70% employees being working less than or equal to ten years, whereas only 12.6% served the organization for more than ten years. By position title, executives made up of half the respondent population with 58% and the rest add up to 29% middle manager, senior managers and above, 5% and non-executives 8%. As stated in the demographic finding, majority of the respondent live in the generation Y (millennials) and Z, where information and communication technology were not an alien to them, as they were raised among this disruptor. The rest of generation will have to embrace the disruption of digital knowledge whereby digital literacy have to be part of their daily working life.

V. Conclusions and Implications

Identifying digital literacy policies are needed to manage the considerable investments that need to be made for digital infrastructure. Policies that are primarily focused on the provision of ICT infrastructure, will not ensure that low/middle income communities optimally utilize these investments. Training is a prerequisite to overcome challenges of technophobia and a general reluctance to engage with modern tools. Managing the provision of digital skills training is crucial to leverage infrastructure investments, however to do so requires accurate, relevant and representative data which presents the total reality of digital illiteracy in a manner that can be used by policy makers and digital trainers to ensure that training programmes are adequately aligned to meet the needs of the rapidly changing labour market associated with the demands of the digitalisation of an evolving and growing political economy.

In the context of oil and gas companies, the basic digital literacy skills needed by every employee to become digital literate are using digital applications to communicate and carry out basic internet searches. In the workplace, digital literacy defines those skills generally linked to the use of applications being developed by employees to elevate the digital economy of the organization, Voogt, Erstad, Dede, & Mishra, (2013). Having a workforce that is more in tune with the digital culture will also make it easier for employees to innovate and create value products and services for its consumers, Lee (2015). For the oil and gas companies, this finding encourages them to provide enough training courses, and facilitate the attendance of technical conferences and presentations for their employees in order for them to be able to evaluate and make recommendations on the adoption of new technologies, Malak (2016)

This study has shown that organizations within oil and gas sectors, of such a corporate size, and working within different marketplaces value digital literacy and undertake engagements that support the creation and implementation of new ideas. Their efforts are considered highly motivating as they focus attention on feedback from customers, employees, and other stakeholders. They challenge their assumptions and invite critical feedback in order to identify new opportunities. Such organizations are not necessarily unique, nor do they possess intellectual secret, instead, they integrate organization activities to promote idea generation and digital literacy implementation to succeed.

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