The Psychological Relationship Model of Factors Affecting Digital Literacy among the Academic Personnel in the Thai Higher Education Institutions Ranked in the World University Rankings

Aphisit Kunnaworapanya[a], Somboon Sirisunhirun[b*], Phut Ploywan[c], Krish Rugchatjaroen[d], Somsak Amornsiriphong[e]

Faculty of Social Sciences and Humanities, Mahidol University, Nakhon Pathom 73170 Thailand

aphisit.kun@mahidol.ac.th

*Corresponding Author. Email: somboon.sir@mahidol.ac.th

E-mail: phut.plo@mahidol.edu, krish.rug@mahidol.ac.th, somsak.amo@mahidol.ac.th

Abstract

This research aimed to study the factors affecting digital literacy (DL) of Thai higher education institutions ranked in the world university rankings developed with empirical data. The sample was 760 academic staffers in Thai higher education institutions ranked among 17 of the world's top universities. A sample size was set based on the number of parameters to $20:1$, and selecting the sample size by using the stratified sampling method, confirmatory factor analysis (CFA) and second order confirmatory factor analysis with advanced ready-made LISREL. program.

According to the findings, the factors affecting DL were human capital development, participation, administration, organizational leadership development of an organizational culture and χ^2 organizational commitment, which is consistent with the empirical data ($=2022.50\,df=1299\,p=0.04251\,GFI=0.98\,AGFI=0.95\,CFI=0.96\,RMSEA=0.024$), with the factor weight values of the latent variables between 0.75-0.94 and the factor weight values of the observed variables between 0.30-0.7 21. Furthermore, the latent extrinsic variables were found to be correlated with the intrinsic latent variables with the correlation values ranging from 0.42-0.96, and the intrinisic latent variables were correlated with values ranging between 0.21-0.94.

Keywords: Causal relationship model, confirmatory factors, digital literacy, academic personnel, Thai higher education institutions ranked in the world university rankings

Introduction

National development follows the previous National Economic and Social Development Plan. As a result, Thailand has developed higher accordingly. The economy has grown. The country has a strong and distinctive production and service base in many fields, and cooperation with bilateral and multilateral friendly countries, as well as cooperation with subregional and ASEAN countries, which has intensified and become more distinct. Expansion of trade and investment opportunities and infrastructure has developed comprehensively with comprehensive services resulting in higher incomes, lower poverty and better quality of life (Office of the National Economic and Social Development Board, Office of the Prime Minister, 2016). The 13th National Economic and Social Development Plan (2023 - 2027), which is the first development plan to begin the process of drafting a framework under the National Strategy and using it as an action plan during the second 5 years of the 20-year National Strategy, embracing the sufficiency economy philosophy as a guiding principle in driving and planning the country's development. To achieve the goals in various dimensions under the national strategy in a tangible way at a time when the world, including Thailand, is facing external and domestic challenges that are highly variable and likely to intensify in the future due to the COVID-2019 pandemic and structural limitations that are still awaiting revision in multiple dimensions, it is necessary to pay attention to both external and internal factors, as well as the consequences of changes in factors that will influence the structure and organization of the country in all dimensions. For use in determining the direction of the country's development, which should be aimed at the future based on the philosophy of sufficiency economy in line with the Sustainable Development Goals (SDGs) of the world, Thailand is also preparing for the digital transformation brought on by digital technology. Thus, the country has adopted digital technology, including information and communication technologies, electronic devices, social media, multimedia, cloud computing, interoperable systems

and mobile devices are used as tools to drive the country's development toward Digital Thailand by creating and utilizing digital technology to its full potential for infrastructure development, innovation, information, human capital and other resources to drive the country's socio-economic development toward stability, prosperity and sustainability (Ministry of Information and Communication Technology, 2016). Digital literacy is key to proving international and national development. National and international organizations have developed and implemented a digital literacy framework to support citizenship in the 21st century. Digital literacy is one of the SDGs and vital to the country's sustainable development (Office of the National Digital Economic and Social Commission, 2019).

Introduced by Gilster (1997), digital literacy is a concept that has been around since 1997 and received constant attention since then. At present, digital literacy is an essential skill for lifestyles in the digital era (Karpati, 2011). Although students have basic knowledge of information technology, this does not mean that they will have the digital literacy skills required to pursue higher education or apply to their work (Jisc, 2010). Furthermore, becoming person with skills in digial literacy should involve greater emphasis on learning basic skills than learning about technology (Verhaaren & Meulemeester, 2009). The ability to use technology is essential for learners to create cognitive and learning processes that will enrich and benefit learning. Although learners need to be digital citizens, technology is not used for the learning process (Ashley, Jarman, Varga-Atkins, & Hassan, 2012). In addition, information technology skills alone are insufficient, while knowledge of the development of ideas is required concerning privacy and security of internet use, creativity and ethics. Moreover, responsibility in using digital literacy is not limited to classroom learning. Rather, learning requires technology to facilitate it, both at home and in academia, in addition to expanding the capabilities of hospitable learning (Meyers, Erickson, & Small, 2013). Digital literacy is, therefore, important for the country's development in order to use innovation and digital technology to create social opportunities with equal information and services through digital media and enhance the quality of life of educational personnel in preparing them for knowledge, skills, understanding and careers for teaching and learning, as well as reforming the models and providing services with digital technology and data utilization to ensure transparency and agility. In the current context, personnel development needs to focus on competency development in order to keep pace with the changing situation of the country and the advancement of technology, particularly in the educational dimension. Therefore, the development of digital literacy is essential for the development of personnel to be efficient and effective in their work performance. Based on the researcher's review of theories and related research, it was found that there are various factors influencing the development of human capital in digital literacy. For Thai higher education institutions ranked in the world university rankings, the importance of organizational culture factors, organizational leadership factors, administrative factors, organizational commitment factors, human capital development factors, and participation factors needs to be recognized. Recognizing this importance, the researcher's interest is in conducting research on the subject of a causal relationship model of the factors influencing digital literacy among personnel at Thai higher education institutions ranked in the world university rankings. To be suitable for the human capital development of personnel and in accordance with the organizational development model, concepts and theory, the researcher worked systematically.

Objectives
To study the factors influencing the digital literacy of personnel at Thai higher education institutions ranked in the world university rankings.

Methodology
This research was endorsed by the In-Person Research Ethics Committee, Department of Social Sciences, Mahidol University, No. 2022/173.1312 MUSSIRB No.2022/201 (B1) dated 13 December 2022 as follows:
1. Population and Sample: 1) The population was Thai 29, 297 personnel at higher education institutions ranked in the world university rankings (Institute for Educational Rankings, 2022). Times Higher Education has ranked world universities with standards based on indicators that are effectively evaluated. Thailand has 17 such higher education institutions, including Mahidol University, Mae Fah Luang University, King Mongkut's University of Technology Thonburi, Chulalongkorn University, Chiang Mai University, Suranaree University of Technology, Khon Kaen University, Thammasat University, King Mongkut's University of Technology Ladkrabang, King Mongkut's University of Technology North Bangkok, Naresuan University, Silpakorn University, Prince of Songkla University, Kasetsart University, Srinakharinwirot University, Burapha University and Mahasarakham

University and 2). The sample group was personnel at Thai higher education institutions in the world university rankings. Since this research was aimed at studying a causal model of factors to be analyzed with advanced statistics and the correlation patterns between variables, the sample size had to be considered along with the number of independent parameters to be estimated using the ratio between the sample unit and the number of parameters or variables 10 - 20 : 1 (Schumacker & Lomax, 2016). The number of parameters (observable variables) was 38 variables Therefore, the researcher determined the sample size based on the sample criteria: the number of parameters was 20 : 1, 760 samples obtained, and the sample size was selected by using stratified sampling, which is a sampling that divides the population into smaller populations and the population units in each landscape layer are homogenous. Then they are randomly randomized to obtain a number of samples in proportion to the sample size and population.

2. The following four external latent variables were studied: (1) organizational culture factors, according to Denison (1990); Cameron and Quinn (1999); Daft (2008); Slocum and Hellriegel (2011); Ivancevich et al. (2011) consisting of the following 4 aspects: (1) Family culture, reactive defense culture, creative culture, and proactive defense culture; (2) Organization leadership factors according to Burns' concept (Burns, 1978, p. 20), Bass (1985), Mosley, Pietri and Megginson (1996, p. 412) composed of the following 4 aspects: ideological influence, inspiration, stimulation of the use of wisdom and consideration of individuality; (3) administrative factors according to the concept of Ekrak Pamwong (2016) and Fayol (Fayol, 1916) consisting of the following 5 aspects: planning, organizational management, command, coordination and control; (4) Organizational commitment factors according to Herzberg's two-factor theory (1959) and consisting of the following 8 aspects: operational success recognition, nature of the work performed, responsibilities, opportunity for progress in the future, relationships with superiors, subordinates, colleagues and 2) Three Internal Latent Variables: (1) Digital literacy according to the concept of the National Digital Economic and Social Commission (2019) consists of 9 aspects: rights and responsibilities in the digital age, digital access, digital communication, digital security, media and information literacy, guidelines in a digital society, digital health, digital commerce and digital laws; (2) Human capital development factors according to the concept of Angkana Sumetsittikun (2014) consist of the following 4 aspects: human capital development; planning,, training and development; monitoring and evaluation; and maintenance and (3) participation according to the concept of Sombat Namburi (2019: 183-197) and Cohen, J.M., & Uphoff, N.T. (1981) consist of the following 4 aspects: participation in decision-making, operations, receiving benefits and evaluation.

3. A research instrument was a questionnaire created and developed by the researcher with an alpha coefficient (Cronbach, 1990) of 0.948 for the entire questionnaire.

4. The statistics used in data analysis of the correlation coefficients between the variables used in studies employed the advanced LISREL program to analyze the correlation characteristics of variables for determining the suitability of the correlation matrix of factors and as preliminary data for the confirmatory factor analysis (Nongluk Wirartchai, 1995). Confirmatory factor analysis and second order confirmatory factor analysis were used to study the weight of importance of the latent variables and to check the consistency of the model with empirical data (Joreskong and Sorbom, 1996: 120-131; Schumacker & Lomax, 2004: 80-81; Nongluk Wirartchai, 2542: 53-55; Poonpong Sooksawang, 2014 and Schumacker & Lomax, 2016). The statistical values used in the assessment were as follows: 1) chi-square statistic per degree of freedom, which had a value of less than 3.00 (x^2/df<3.00) and should have a much lower value the closer it comes to zero or a value equal to the degree of freedom. Apart from the chi-square statistic, there must be no statistical significance at 0.05, which shows that the matrix of variance of the empirical data is no different from the total variance from the estimate, which shows that the LISREL model corresponds with the empirical data; 2) The Root Mean Sqaure of Error Approximation (RMSEA) had a value lower than 0.05, which shows that the theoretical model corresponded with the empirical data; 3) The Goodness of Fit Index (GFI) and the Adjusted Goodness of Fit Inex (AGFI) should have values exceeding 0.95 or a value close to 1.00, which shows that the model fit with the empirical data and 4) An Adjusted Goodness of Fit Index (AGFI) (Hair, J. F., Black, W. C., Babin, B. J., & Anderson, R. E., 2019).

5. The scope of the time set for the study was 11 months from April 2022 to February 2023.

Findings

1. According to confirmatory factor analysis of the factors with influence over digital literacy among academic personnel in Thai higher education institutes ranked in world university rankings based on the causal relationship model of latent factors and observed variables, every measurement model was found to have goodness of fit with a chi-square score of 0.00 - 34.58, statistical significance (p) at 0.00000 - 1.00000. The goodness of fit index (GFI) of every measurement model was 0.99 – 1.00, the adjusted goodness of fit index (AGFI) was 0.95 - 1.00 and the root mean square equation of approximation (RMSEA)

was 0.000 - 0.049 0.000. Therefore, all seven models were concluded to have fitted evidence-based data. When each area of confirmatory components was considered separately, latent factors and observed variables in every areas was found to have fitted evidence-basefd data as follows:

1) Digital literacy fitted with evidence-based data and had nine observed variables considered from a chi-square score of 34.58; p = 0.63663 at a degree of independence of 1, a goodness of fit index (GFI) of 1.00, an adjusted goodness of fit index (AGFI) of 0.95, a comparative fit index (CFI) of 1.00 and a root mean square error of approximation (RMSEA) of 0.049. When component weight was considered, the nine observed variables had a component weight range of 0.38 to 0.52, indicating fitness with evidence-based data ($\chi^2 = 34.58$ df = 1 p = 0.63663 GFI = 1.00 AGFI = 0.95 CFI = 1.00 RMSEA = 0.049).

2. Organizational culture fitted with evidence-based data and had four observed variables considered from a chi-square score of 2.81; p = 0.24555 at a degree of independence of 1, a goodness of fit index (GFI) of 0.98, an adjusted goodness of fit index (AGFI) of 0.98, a comparative fit index (CFI) of 1.00 and a root mean square error of approximation (RMSEA) of 0.036. When component weight was considered, the four observed variables had a component weight range of 0.45 to 0.58, indicating fitness with evidence-based data ($\chi^2 = 2.81$ df = 2 p = 0.24555 GFI = 1.00 AGFI = 0.98 CFI = 1.00 RMSEA = 0.036).

3. Organizational leadership fitted with evidence-based data and had four observed variables considered from a chi-square score of 0.18; p = 0.66927 at a degree of independence of 1, a goodness of fit index (GFI) of 1.00, an adjusted goodness of fit index (AGFI) of 1.00, a comparative fit index (CFI) of 1.00 and a root mean square error of approximation (RMSEA) of 0.000. When component weight was considered, the four observed variables had a component weight range of 0.40 to 0.49, indicating fitness with evidence-based data ($\chi^2 = 0.18$ df = 1 p = 0.66927 GFI = 1.00 AGFI = 1.00 CFI = 1.00 RMSEA = 0.000).

4. Administration fitted with evidence-based data and had five observed variables considered from a chi-square score of 59.76; p = 0.00000 at a degree of independence of 1, a goodness of fit index (GFI) of 1.00, an adjusted goodness of fit index (AGFI) of 1.00, a comparative fit index (CFI) of 1.00 and a root mean square error of approximation (RMSEA) of 0.000. When component weight was considered, the five observed variables had a component weight range of 0.41 to 0.50, indicating fitness with evidence-based data ($\chi^2 = 59.76$ df = 5 p = 0.00000 GFI = 1.00 AGFI = 1.00 CFI = 1.00 RMSEA = 0.000)

5. Organizational commitment fitted with evidence-based data and had eight observed variables considered from a chi-square score of 4.07; p = 0.39710 at a degree of independence of 1, a goodness of fit index (GFI) of 1.00, an adjusted goodness of fit index (AGFI) of 0.97, a comparative fit index (CFI) of 1.00 and a root mean square error of approximation (RMSEA) of 0.007. When component weight was considered, the eight observed variables had a component weight range of 0.28 to 0.59, indicating fitness with evidence-based data ($\chi^2 = 4.07$ df = 4 p = 0.39710 GFI = 1.00 AGFI = 0.97 CFI = 1.00 RMSEA = 0.007).

6. Human capital development fitted with evidence-based data and had four observed variables considered from a chi-square score of 1.39; p = 0.23879 at a degree of independence of 1, a goodness of fit index (GFI) of 1.00, an adjusted goodness of fit index (AGFI) of 0.98, a comparative fit index (CFI) of 1.00 and a root mean square error of approximation (RMSEA) of 0.035. When component weight was considered, the four observed variables had a component weight range of 0.39 to 0.51, indicating fitness with evidence-based data ($\chi^2 = 1.39$ df = 1 p = 0.23879 GFI = 1.00 AGFI = 0.98 CFI = 1.00 RMSEA = 0.035).

7. Participation fitted with evidence-based data and had four observed variables considered from a chi-square score of 0.00; p = 1.00000 at a degree of independence of 1, a goodness of fit index (GFI) of 0.99, an adjusted goodness of fit index (AGFI) of 0.91, a comparative fit index (CFI) of 0.99 and a root mean square error of approximation (RMSEA) of 0.000. When component weight was considered, the four observed variables had a component weight range of 0.39 to 0.55, indicating fitness with evidence-based data ($\chi^2 = 0.00$ df = 0 p = 1.00000 GFI = 0.99 AGFI = 0.91 CFI = 0.99 RMSEA = 0.000) according to the information shown in Table 1-1.

Table 1-1:   Shows the confirmatory factor analysis based on relative model values, latent factors and observable variables.

Variable Measured	Confirmatory Factors						
	χ^2	df	p	GFI	AGFI	CFI	RMSEA
Digital Literacy (DL)	34.58	1	0.63663	1.00	0.95	1.00	0.049
Organizational Culture (OR)	2.81	2	0.24555	1.00	0.98	1.00	0.036
Organizational Leadership (OL)	0.18	1	0.66927	1.00	1.00	1.00	0.000
Administration (AD)	59.76	5	0.00000	1.00	1.00	1.00	0.000
Organizational Commitment (OC)	4.07	4	0.39710	1.00	0.97	1.00	0.007
Development of Human Capital (HC)	1.39	1	0.23879	1.00	0.98	1.00	0.035
Participation (PA)	0.00	0	1.00000	0.99	0.91	0.99	0.000

Second order confirmatory factor analysis of factors with influence over digital literacy among academic personnel in Thai higher education institutes ranked in world university rankings found the model to have a chi-square score of 2022.50; p = 0.04251 at a degree of independence of 1 with a goodness of fit index (GFI) of 0.98, an adjusted goodness of fit index (AGFI) of 0.95, a comparative fit index (CFI) of 0.96 and a root mean square error of approximation of 0.024. This showed the model to have fitted with evidence-based data. In other words, the created instrument consisting of organizational culture (OR), organizational leadership (OL), administration (AD), organizational commitment (OG), human capital development (HC) and participation (PA) fitted with evidence-based data. Organizational culture (OR) had the heaviest weight of significance, followed by organizational leadership (OL), participation (PA), human capital development (HC), administration (AD) and organizational commitment (OG) respectively. Furthermore, the analysis explained further that:

Human capital development was measured from Observed Variables X22 - X25. The variable of retention (X25) had the heaviest weight of significance, followed by human capital development planning (X22), training and development (X23), monitoring and assessing results (X24), respectively.

Participation was measured from Observed Variables X26 - X29. Participation in work (X27) was found to have the heaviest weight of significance, followed by participation in decision-making (X26), participation in assessing results (X29) and participation in receiving benefits (X28), respectively.

Organizational culture (OR) was measured from Observed Variables X1 - X4. Creative culture (X3) was found to have the heaviest weight of significance, followed by proactive prevention culture (X4), passive prevention culture (X2) and familial culture (X1), respectively.

Organizational leadership (OL) was measured from Observed Variables X5 - X8. Ideological influence (X5) and consideration of individuality (X8) had the heaviest weight of significance, followed by encouragement of intelligence (X7) and inspiration (X6), respectively.

Administration (AD) was measured from Observed Variables X9 - X13. Planning (X9) was found to have the heaviest weight of significance, followed by control (X13), organization management (X10), coordination (X12) and command (X11), respectively.

Organizational commitment (OG) was measured from Observed Variables X14 - X21. Responsbility (X17) was found to have the heaviest weight of significance, followed by respect (X15), relationships with supervisors, subordinates and colleagues (19), opportunities of advancement in the future (X18), work success (X14), work security (X21), work characteristics (16), personal living conditions (X20), respectively, according to the information shown in Table 1-1.
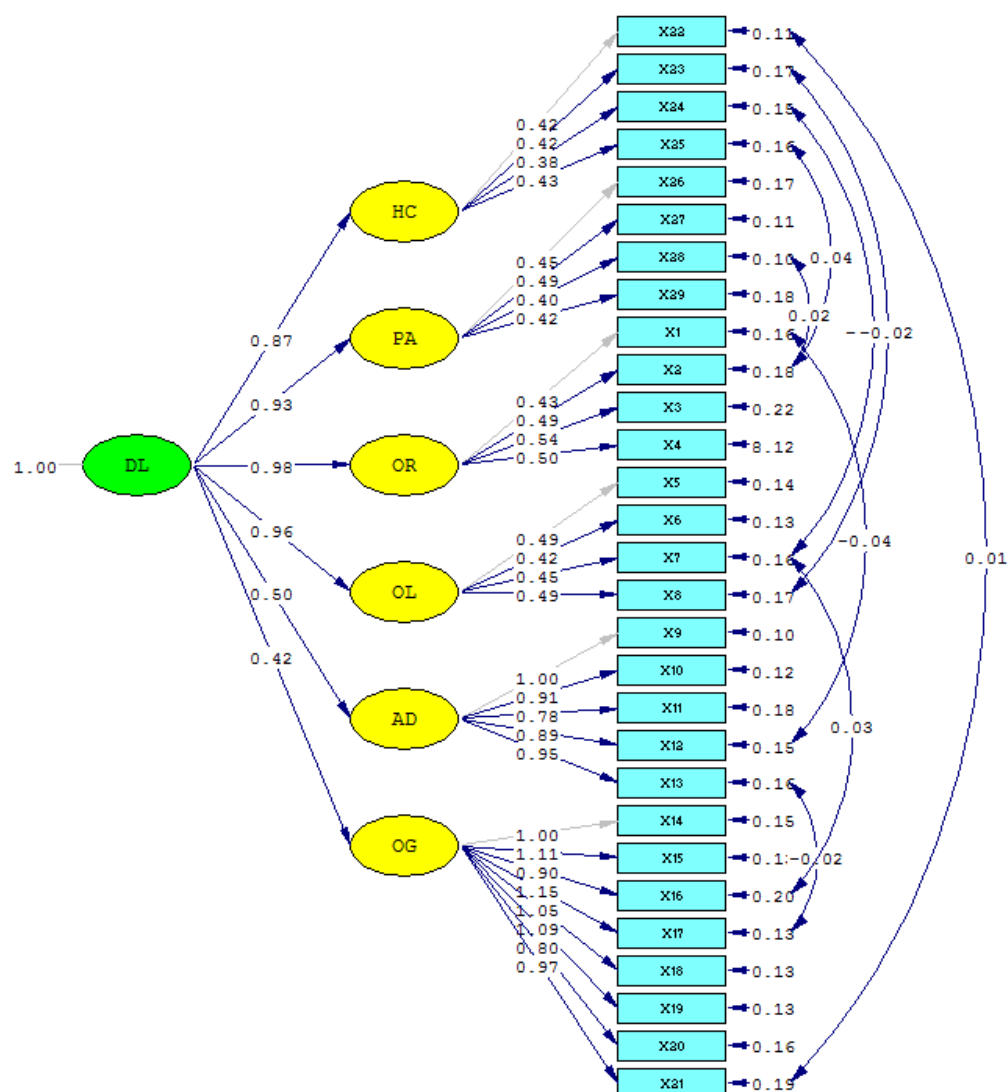
Chi-Square=2022.50, df=1299, P-value=0.04251, RMSEA=0.024

Figure 1-1 – Second Order Confirmatory Factor Analysis (CF)

When correlations between latent variables of the causal relationship model of factors with influence over digital literacy among academic personnel in Thai higher education institutes ranked in world university rankings were analyzed, external latent variables were found to be correlated with internal latent variables with correlations in the range of 0.42 - 0.96 and internal latent variables had correlations in the range of 0.21 - 0.94 as shown in Table 1-2.

Table 1-2: Correlation Coefficients between Latent Variables of the Causal Relationship Model of Factors with Influence Over Digital Literacy among Academic Personnel in Thai Higher Education Institutes Ranked in World University Rankings

Variables	HC	PA	OR	OL	AD	OG	DL
HC	1.00						
PA	0.81	1.00					
OR	0.86	0.91	1.00				
OL	0.84	0.89	0.94	1.00			
AD	0.44	0.46	0.49	0.48	1.00		
OG	0.36	0.39	0.41	0.40	0.21	1.00	
DL	0.87	0.93	0.98	0.96	0.50	0.42	1.00

When confirmatory factor analysis (CFA) of the causal relationship model of factors with influence over digital literacy among academic personnel in Thai higher education institutes ranked in world university rankings was considered, the model was found to have fitted evidence-based data. In other words, the created instrument consisting of organizational culture (OR), organizational leadership (OL), administration (AD), organizational commitment (OG), human capital development (HC) and participation (PA) fitted with evidence-based data. Organizational culture (OR) had the heaviest weight of significance, followed by organizational leadership (OL), organizational commitment (OG), administration (AD), participation (PA) and human capital development (HC), respectively, as shown in Table 1-3.

Table 1-3: Results from Second Order Confirmatory Factor Analysis

Latent Variables	Second Order Confirmatory Factor Analysis			
	DL			R^2
	b	SE	t	
HC	0.87	0.06	13.89	0.75
PA	0.93	0.07	13.95	0.87
OR	0.98	0.07	14.55	0.94
OL	0.96	0.06	16.01	0.93
AD	0.50	0.03	17.49	0.88
OG	0.42	0.03	14.59	0.90
$\chi^2 = 2022.50$ df $= 1299$ p $= 0.04251$ GFI $= 0.98$ AGFI $= 0.95$ CFI $= 0.96$ RMSEA $= 0.024$				

Discussion of the Findings

According to confirmatory factor analysis of factors with influence over digital literacy among academic personnel in Thai higher education institutes ranked in world university rankings, examination of fitness of measurement models show fitness of every measurement model with a chi-square score of 0.00 - 34.58 and statistical significance (p) at 0.00000 - 1.00000. The goodness of fit index (GFI) of every measurement model was 0.99 - 1.00, the adjusted goodness of fit index (AGFI) was 0.95 - 1.00 and the root mean square equation of approximation (RMSEA) was 0.000 - 0.049 0.000. Therefore, all seven models were concluded to have fitted evidence-based data. When each area was considered separately, confirmatory components of factors with influence over digital literacy among academic personnel in Thai higher education institutes ranked in world university rankings from the causal relationship model, latent variables and observed variables in every model fitted evidence-based data. This was consistent with an academic article by Poonsong Sooksawang (2014) who stated that, in determining whether

a developed model fits evidence-based data, the main principle for consideration is chi-square statistics, which are used to test goodness of fit. The calculated chi-square score will have a value of zero and up. The closer chi-square scores are closer to zero, the more a hypothesized model is likely to fit evidence-based data. However, if the chi-square score is zero, the model is a saturated model. The LISREL program will show analysis results as "The Model is Saturated, the Fit is Perfect!", which may mean that the model is good. However, consideration should be given to determine if the model's degree of independence is zero (df = 0) or not. If yes, the model is a just-identified model because estimation of all posstible parameters makes the model saturated. If consideration was given according to the principle of calculating chi-square scores in comparison with critical chi-square scores, no critical chi-square scores at the position where the independent degree score is zero. Therefore, in the fact that chi-square scores were calcuculated to be zero, the degree of independence must be tested to determine if it is zero. If yes (df = 0), the degree of independence should be returned to the model by specifying a fixed parameter. The researcher would like to discuss the findings as follows:

1. Digital literacy with nine observed variables consisting of rights and responsibilities in the digital age, digital access, communications in the digital age, safety in the digital age, media and information literacy, guidelines in digital society, good health in the digital age, digital commerce and digital law was found to have fitted evidence-based data ($\chi^2 = 34.58$ df = 1 p = 0.63663 GFI = 1.00 AGFI = 0.95 CFI = 1.00 RMSEA = 0.049). This was because digital literacy is important for national development and economic competition. Digital innovation and technology is used to create social opportunities through equitable provision of news, information and services via digital media in order to improve quality of life for personnel to have knowledge, skills, understanding and occupations in addition to reforming views and service provision with digital technology including use of information to create work transparency and efficiency in order to drive the national economy and digital society. Academic personnel in Thai higher education institutes ranked in world university rankings need to have knowledge, understanding, ability and capacity to access, search, screen, analyze, synthesize, assess, implement communications, create, share and follow-up on data, information and content with appropriateness, safety, responsibility, manners, respect for rights and laws through use of suitable and diverse instruments and technologies. Digital literacy development guidelines must consider national growth in the Thailand 4.0 era, digital literacy of academic personnel or educators, 21st century learning skills, digital literacy skills and information and communication technology development courses according to concepts of the Office of the National Economic and Social Development Council (20019) in order to support good development of academic personnel.

2. Organization culture with four observed variables consisting of familial culture, passive prevention culture, creative culture and proactive prevention culture fitted with evidence-based data ($\chi^2 = 2.81$ df = 2 p = 0.24555 GFI = 1.00 AGFI = 0.98 CFI = 1.00 RMSEA = 0.036). This was because organization culture is the lifestyle of organization personnel who conform continually until organization culture became a specific personnel characteristic and an important foundation for the organization to operate smoothly and sustainably. Organization culture is unique to each organization and is created from connections between personal attitude, values, beliefs, norms and actions of organization personnel, organization policies and objectives, technology and the organization's success until organization culture becomes accepted by academic personnel in Thai higher education institutes ranked in world university rankings. This was consistent with the concept of Tanakrit Premsawad (2015) who stated government organizations have clearly visible characteristics from having detailed and strict rules and regulations for internal operations. Government personnel are organized in positions and duties from the top level to the bottom level. Management and operations in government organizations including communications mainly depend on documents. These documents are usually stored as evidence of operations with work divided based on specific personnel capabilities, causing lesser work units to be created in organizations. Executive government organization personnel need to have knowledge and capabilities in performing duties and using the organization's regulations.

3. Organizational leadership with four observed variables consisting of ideological influence, inspiration, encouragement of intelligence and consideration for univocality was found to have fitted evidence-based data ($\chi^2 = 0.18$ df = 1 p = 0.66927 GFI = 1.00 AGFI = 1.00 CFI = 1.00 RMSEA = 0.000). This showed organizations were able to lead organizations by using influence to motivate or command personnel's trust, confidence and compliance until teams or groups achieve success according to goals including leaders' awareness and perception of personnel needs, the ability to find motivations and encourage personnel to have that desire in addition to developing followers to fully use personal capabilities. This was consistent with the Transformational Leadership theory of Bass (1985) which states transformation leaders can combine innovations and changes in expectations, ideas and

conscientiousness among organization personnel with personnel needs, quality of life and living conditions along with giving importance to other values of the organization such as the organization's vision, participation from organization members, relationship building between organization members by using work skills such as prestige or ideological influence to motivate personnel to work more than the specified goal, motivation to inspire personnel and cause personnel to accept concepts, values and beliefs of leaders and work according to that concept. Intellectual encouragement is leaders' encouragement for personnel to use creative views at work and support expressions of independent opinions and reasons without obstructing different opinions while considering individuality. Leaders will express care and concern for personnel personally and at work including paying attention to the needs of individual personnel.

4. Administrative factors with five observed variables consisting of planning, organization management, command, coordination and control were found to have fitted with evidence-based data ($\chi^2 = 59.76$, df = 5 p = 0.00000 GFI = 1.00 AGFI = 1.00 CFI = 1.00 RMSEA = 0.000). This showed organization leaders have administrative skills that use both science and art to make work succeed according to the organization's goals by using resources to maximum benefit by working according to the administrative process. Administrators depended on authority, duties, leadership, administrative skills and knowledge to work successfully and effectively according to objectives and goals. The findings were consistent with the concept of Fayol (1916) who stated the administrative process consists of planning as a study of the future and work planning. Organization is a work in terms of materials and personnel in that organization. Command is the act of causing colleagues to work while coordination is an integration and management to create relationships in all activities in the organization while control is the act of seeing behaviors happen in the organization which followed outlined rules.

5. Organizational commitment with eight observed variables consisting of work success, acceptance and respect, job characteristics, responsibilities, opportunities for advancement in the future, relationships with supervisors, subordinates and colleagues, privacy and security at work fitted with evidence-based data ($\chi^2 = 4.07$ df = 4 p = 0.39710 GFI = 1.00 AGFI = 0.97 CFI = 1.00 RMSEA = 0.007). Therefore, the organization should encourage personnel to have satisfaction in the organization and work effectively along with creating motivation to work at all times in order for academic personnel in Thai higher education institutes ranked in world university rankings to have positive feelings towards the organization, love, pride and attention towards the organization, feel personnel are a part, have confidence, full acceptance of the organization's goals and values and sacrifice personal happiness for the organization's goals and a desire to maintain membership of the organization. This was consistent with Hertzberg's theory (1959), which stated that, for organization personnel to have organizational commitment with the intention and willingness to work and achieve the organization's objectives, the organization needs to meet personnel needs correctly and apporpirately while recognizing that personnel have different needs, which will ultimately cause personnel to have satisfaction and commitment to the organization.

6. Human capital development with four observed variables consisting of human capital development planning, training and development, monitoring and assessment, and maintenance was found to have fitted with evidence-based data ($\chi^2 = 1.39$ df = 1 p = 0.23879 GFI = 1.00 AGFI = 0.98 CFI = 1.00 RMSEA = 0.035). The findings showed development of human capital is a necessary and vital resource. Significant amounts of human capital are needed for many tasks because human capital create services and are service providers that focus on quality, standards, safety, morals and ethics. Acquisition of quality human capital and development and retention of human capital with the organization to work effectively for the organization along with departing from the organization in good terms depends on good human capital management. This is consistent with the concept of Mondy & Noe (1996) who stated human capital development is the main duty of human capital management consisting of training, developing, planning and developing careers, organizations and assessing results with training designed to increase knowledge and skills according to current work needs while development is employees' learning for long term use in the future. In addition, the findings were in agreement with the concept of Carrell, Ebert and Hatfield (2000) who stated human capital development is planned actions of organizations to improve personnel knowledge, skills and capabilities or a process of developing the organization's personnel to be more effective and responsible at work, causing personnel and the organization to be effective in working to achieve the organization's goals and objectives.

7. Participation with four observed variables consisting of participation in decision-making, participation in operations, participation in receiving benefits and participation in assessments was found to have fitted with evidence-based data ($\chi^2 = 0.00$ df = 0 p = 1.00000 GFI = 0.99 AGFI = 0.91 CFI = 0.99 RMSEA = 0.000). Therefore, the organization should allow

personnel to become directly or indirectly involved in development work by participating in thinking, making decisions, planning and working according to projects along with monitoring and assessing to achieve desirable goals and allocate resources to achieve objectives and willingly work according to plans or projects. The findings concurred with the concept of Cohen & Uphoff (1981) who stated personnel participation must be in four dimensions consisting of participation in decisions on what and how work should be done, participation in sacrificing for development and working according to decisions, participation in sharing benefits from work and participation in assessing results from projects including participation in determining problems and causes of problems in the organization, participation in making decisions to determine needs and participation in ranking the order of needs.

Second order confirmatory factor analysis of academic personnel in Thai higher education institutes ranked in world university rankings found the model to have fitted evidence-based data ($\chi^2 = 2022.50$ df $= 1299$ p $= 0.04251$ GFI $= 0.98$ AGFI $= 0.95$ CFI $= 0.96$ RMSEA $= 0.024$). In other words, the model is an instrument created with components consisting of organizational culture (OR), organizational leadership (OL), administration (AD), organizational commitment (OG), human capital development (HC) and participation (PA). The model fitted with evidence-based data, which shows digital literacy as important to personnel in preparing personnel to have knowledge, skills, understanding and occupations including reforming paradigms and service provision with digital technology and benefiting from data in order to create work transparency, flexibility and efficiency. In current contexts, personnel development must have importance placed on developing capabilities to keep in step with the country's situation, changes and technological advancements, particularly in the area of education. One of the major factors for organizations is suitable human capital development methods for the organization by supporting the organization to achieve goals according to outlined strategies and allowing the organization's personnel to use personal knowledge and ability to perform assignments and responsibilities successfully along with creating a competitive advantage. Existing human capital who have knowledge, ability and expertise can be used to create a difference for the organization, create advantage over competitors and develop the organization by creating survivability and sustainable growth. Therefore, the researcher would like to discuss the findings as follows:

Human capital development was measured from Observed Variables X22 - X25. The variable of retention (X25) had the heaviest weight of significance, followed by human capital development planning (X22), training and development (X23), monitoring and assessing results (X24), respectively. Therefore, personnel retention is a role for executives in order to retain good quality personnel to benefit the organization as long as possible. If an organization is unable to retain capable personnel, the organization will have difficulties in developing to prosper and grow. Personnel retention is a duty for supervisors and executives and not only the work of the personnel department. Personnel retention ultimately increases productivity and, when retaining personnel, the organization must support and develop personnel capabilities in order for personnel to remain with the organization with value and have plans for developing career progress with higher capabilities, which will cause personnel to love the organization, work and dedicate physical and mental energy to work to the best ability and produce good and concrete academic achievements at the international level, which is consistent with the concept of Angkana Sumetsittikun (2014).

Participation was measured from Observed Variables X26 - X29. Participation in work (X27) was found to have the heaviest weight of significance, followed by participation in decision-making (X26), participation in assessing results (X29) and participation in receiving benefits (X28), respectively. This showed allowing personnel to participate in thinking, making work decisions and sharing in responsibilities affected personnel. Furthermore, in enabling personnel to participate in making developments to solve work problems, leading to better living conditions for personnel, leaders must accept the development philosophy that every human wishes to live with others happily, be treated fairly, be accepted by others and be willing to dedicate themselves to activities for the common good in the organization, which is consistent with the concepts of Sombat Namburi (2019; 183-197) and Cohen, J.M., & Uphoff, N.T. (1981).

Organizational culture (OR) was measured from Observed Variables X1 - X4. Creative culture (X3) was found to have the heaviest weight of significance, followed by proactive prevention culture (X4), passive prevention culture (X2) and familial culture (X1), respectively. This showed organizations placed importance on work values with an aim to support personnel to interact and support one another, having values and work behavior expressions with good overall work characteristics, having shared goals and creative personnel expressions with a focus on personnel needs and expectations. Work goals were more on work quality than quantity. Organizations had a participatory and personnel-centered management model with priority given to personnel by considering personnel as the most valuable resource of the organization and emphasizing on familiar, open and

honest interpersonal relationships between personnel in the organization with sensitivity for the feelings of colleagues and team members. Therefore, creative organizational culture is an organization with plans for behaviors and expressions that place importance on work values with an emphasis on satisfaction among organization personnel, an emphasis on supporting organization personnel to interact with one another and have good relationships when working together and supporting one another to love and unite in addition to having work characteristics that support the organization's personnel to work successfully in line with the concept of Denison (1990); Cameron and Quinn (1999); Daft (2008); Slocum and Hellriegel (2011); Ivancevich et al. (2011).

Organizational leadership (OL) was measured from Observed Variables X5 - X8. Ideological influence (X5) and consideration of individuality (X8) had the heaviest weight of significance, followed by encouragement of intelligence (X7) and inspiration (X6), respectively. This showed leaders as individuals with important roles in the organization. Leadership change is a process with influence over changes in attitude and assumptions among the organization's personnel which creates commitment to change, key objectives and strategies. Leadership change concerns leaders who have influence over personnel and influence empowers personnel to become leaders who make changes in the organization's work units. Therefore, leadership of change is viewed as a holistic process involving operations in every work unit including minor work units of the organization. Leaders transfer major duties, responsibilities and authority along with eliminating unnecessary ork limitations. Leaders care for and teach skills to personnel who need to solve problems, want to take initiative, encourage participation in making major decisions, encourage competition in thought, awareness of information, promotion of cooperation and teamwork including support for create solutions in managing conflicts in the organization. Leaders will modify organization structures and management systems for the organization's main objectives. For the organization to become successful, change must happen and leaders will pay attention to each person's needs to support achievement of success and development. Leaders are comparable to educators or consultants who create good opportunities in creating and learning new things. Leaders will improve capabilities of followers and colleagues while treating followers by providing learning opportunities, creating and atmosphere of support, considering personal differences in the area of necessity and leadership needs, promoting two-way communication, personally interact with followers and pay attention to followers' concerns along with viewing individuals as individuals by empathizing and allowing followers to use leaders' prestige and learn new challenges, which is consistent with the concepts of Burns (1978, p. 20), Bass (1985), Mosley, Pietri and Megginson (1996, p. 412).

Administration (AD) was measured from Observed Variables X9 - X13. Planning (X9) was found to have the heaviest weight of significance, followed by control (X13), organization management (X10), coordination (X12) and command (X11), respectively. This showed the top priority duty for executives in administration was planning because planning helps personnel to see correlations between activities which must be done until goals are achieved, thereby enabling personnel to perform assigned missions appropriately according to needs. Executives must study the organization's future and make plans for work in the organization, which is consistent with the concepts of Ekarak Parmwong (2016) and Fayol (1916).

Organizational commitment (OG) was measured from Observed Variables X14 - X21. Responsbility (X17) was found to have the heaviest weight of significance, followed by respect (X15), relationships with supervisors, subordinates and colleagues (19), opportunities of advancement in the future (X18), work success (X14), work security (X21), work characteristics (16), personal living conditions (X20), respectively. This showed personnel who had positive feelings towards the organization, love, pride, attention to the organization and felt as part of the organization to have fully believed and accepted the organization's goals and values along with sacrificing personal happiness for goals with a desire to maintain membership in the organization, having satisfaction from receiving new assignments and responsibilities and good authority and responsibility without close supervision or monitoring, which was consistent with Herzberg's two factor theory (1959).

According to results from analysis of correlations between latent variables of the causal relationship model of factors with influence over digital literacy among academic personnel in Thai higher education institutes with world university rankings, external latent variables were found to be correlated with internal latent variables with correlations in the arrange of 0.42 - 0.96 and interal latent variables were found to be correlated in the range of 0.21 - 0.94 because digital literacy is important for development of use of innovations and digital technology, particularly in the area of education. Moreover, analysis of relevant documents, concepts, theories and research found factors with influence over human capital development in the area of digital literacy among academic personnel in Thai higher education institutes ranked in world university rankings consisting of organizational culture, organizational leadership, administration, organizational commitment, human capital development and

participation. Organizational culture had effects on performance in terms of administration and development including cultures of participation, emphasis on individuality, adaptation and obligations. Organizational leadership was vital to organizations. Visionary organization leaders were able to lead organizations towards designated goals and were able to attract skills and capabilities for use in inspiring and compelling followers along with having the ability to persuade followers to follow, compromising with reason, motivating followers to dedicate ability and sacrifice for the organization and becoming a center for followers while daring to make decisions to lead the organization towards goals in order to achieve objectives. Leaders need to depend on leadership authority and duties, administrative skills and knowledge consisting of planning, organization management, command, coordination and control to achieve objectives and goals effectively. In addition, the current age is the age of change from representative democracy to participatory demogracy. Participatory work is important for paradigms to help participants feel ownership, which will make participants consent to follow, agree and accept willingly, fully and comfortably to solve problems and disorder by a participatory process. The key factor for organizations is finding appropriate human capital development methods for the organization, which is important for human capital in the organization in order to allow the organization to achieve goals according to outlined strategies. Human capital development for the organization is a major necessary resource and significant human capital is needed for many tasks because human capital create services and provide healthcare services with a focus on quality, standards, safety, morals and ethics in order to create positive feelings toward the organization with love, pride and attention to the organization while feeling as a part with full belief and acceptance of the organization's goals and values along with sacrificing personal happiness for goals and desiring to maintain membership in that organization forever.

Discoveries

According to results from confirmatory factory analysis of factors with influence over digital literacy among academic personnel in Thai higher education institutes ranked in world university rankings, goodness of fit of the measuring model was found to be fit in every measuring model with a chi-square score of 0.00 - 34.58 and a statistical significance (p) at 0.00000 - 1.00000. Goodness of fit (GFI) of every measuring model was at 0.99 - 1.00, adjusted goodness of fit index (AGFI) was at 0.95 - 1.00 and the root mean square error of approximation (RMSEA) was at 0.000 - 0.049. Therefore, all seven measuring models were found to be fit. When components of each factor were considered, latent factors and variables were observed in every aspect to fit evidence-based data as follows:

1. Digital literacy with nine observed variables consisting of rights and responsibilities in the digital age, digital access, communications in the digital age, safety in the digital age, media and information literacy, guidelines in digital society, good health in the digital age, digital commerce and digital law fitted with ($\chi^2 = 34.58$ df = 1 p = 0.63663 GFI = 1.00 AGFI = 0.95 CFI = 1.00 RMSEA = 0.049) evidence-based data.

2. Organization culture with four observed variables consisting of familial culture, passive prevention culture, creative culture and proactive prevention culture fitted with evidence-based data ($\chi^2 = 2.81$ df = 2 p = 0.24555 GFI = 1.00 AGFI = 0.98 CFI = 1.00 RMSEA = 0.036).

3. Organizational leadership with four observed variables consisting of ideological influence, inspiration, encouragement of intelligence and consideration for univocality fitted evidence-based data ($\chi^2 = 0.18$ df = 1 p = 0.66927 GFI = 1.00 AGFI = 1.00 CFI = 1.00 RMSEA = 0.000).

4. Administrative factors with five observed variables consisting of planning, organization management, command, coordination and control fitted with evidence-based data ($\chi^2 = 59.76$, df = 5 p = 0.00000 GFI = 1.00 AGFI = 1.00 CFI = 1.00 RMSEA = 0.000).

5. Organizational commitment with eight observed variables consisting of work success, acceptance and respect, job characteristics, responsibilities, opportunities for advancement in the future, relationships with supervisors, subordinates and colleagues, privacy and security at work fitted with evidence-based data ($\chi^2 = 4.07$ df = 4 p = 0.39710 GFI = 1.00 AGFI = 0.97 CFI = 1.00 RMSEA = 0.007)

6. Human capital development with four observed variables consisting of human capital development planning, training and development, monitoring and assessment, and maintenance fitted with evidence-based data ($\chi^2 = 1.39$ df = 1 p = 0.23879 GFI = 1.00 AGFI = 0.98 CFI = 1.00 RMSEA = 0.035).

7．Participation with four observed variables consisting of participation in decision-making, participation in operations, participation in receiving benefits and participation in assessments fitted with evidence-based data ($\chi^2 = 0.00$ df $= 0$ p $= 1.00000$ GFI $= 0.99$ AGFI $= 0.91$ CFI $= 0.99$ RMSEA $= 0.000$).

When the second order confirmatory factor analysis of factors with influence over digital literacy among academic personnel in Thai higher education institutes ranked in world university rankings was carried out, chi-square was 2022.50; p $= 0.4251$ with an independent degree of 1 and a goodness of fit index (GFI) of 0.98, an adjusted goodness of fit index (AGFI) of 0.95, a comparative fit index (CFI) of 0.96 and a root mean square error of approximation (RMSEA) of 0.024. This showed the model was consisted with evidence-based data. When correlation coefficients of latent variables of the causal relationship model of factors with influence over digital literacy were analyzed, external latent variables were found to be correlated with internal latent variables with a correlation size in the range of $0.2 - 0.96$ and internal latent variables had correlations in the range of 0.21 - 0.94. When confirmatory factor analysis (CFA) of the causal relationship model of factors with influence over digital literacy among academic personnel in Thai higher education institutes ranked in world university rankings was considred, the model was found to be consistent with evidence-based data. In other words, the created instrument consisting of organization culture (OR), organizational leadership (OL), administration (AD), organizational commitment (OG), human capital development (HC) and participation (PA) fitted with evidence-based data with organization culture having the highest weight of significance, followed by organizational leadership, organizational commitment, administration, participation and human capital development, respectively.

Recommendations

1．Recommendations from the Findings: 1) personnel should be encouraged and supported to have knowledge, understanding, ability and competence in learning the rights of digital citizens and understand responsibility in the online world in the 21st century; 2) organizations should be managed in order to create love and respect for the organization among personnel by emphasizing participation, teamwork and recognition of the importance of personnel and work at the same time by seeking better work guidelines; 3) personnel should be persuaded and motivated to accept work according to specifications in addition to being encouraged to work as a team by clearly explaining work visions and goals along with expressing confidence in the ability to achieve challenging goals above the standard; 4) personnel should be managed and methods should be found to help personnel have relationships in every activity in the organization in order to build teamwork and unity in working for the organization's success; 5) personnel should be encouraged, supported, managed and methods should be found to create satisfaction in new assignments among personnel with good authority in accepting responsibilities; 6) possibility analyses should be conducted to anticipate future needs and future personnel needs along with being able to determine target group, seek expertise, recruit, select and use data to make clear plans to determine guidelines in order to prepare and develop human capital; and 7) personnel should be allowed to participate in determining needs, making decisions and prioritizing the organization's operations from early decisions, decisions during operatioins and planning and decisions when following plans.

2. Practical Recommendations: 1) Personnel should be encouraged and supported to have understanding and the ability to learn about rights of access and non-discimination including responsibility in using digital media; 2) personnel should be encouraged and supported to have understanding when learning basic principles of media and media service providers along with basic media and information management; 3) personnel should be encouraged and supported to have knowledge in basic learning of data and information principles, internet literacy, the ability to use tools to connect to the internet and the ability to use search programs quickly and accurately as desired; 4) personnel should be encouraged and supported to have knowledge and understanding of communication principles, communication in the digital age or communications via online society in order to distinguish between personal space and public space; 5) personnel should be encouraged and supported to have knowledge and understanding in learning the basics of digital commerce, the ability to purchase/sell products correctly and safely; 6) personnel should be encouraged and supported to have knowledge and understanding of laws concerning work, intellectual property laws and digital economy laws; 7) organization plicies should be modified to have a culture of working together as a family in which every person respects and listens to one another with good communications and strong relationships between members; 8) visions should be developed for subordinates to understand and accept policies along with being ready to achieve organization goals and personnel should sacrifice, be dedicated and endure; 9) subordinates should be given care, attention, advise and recognition on an individual level to help determine problems and meet needs of subordinates in a familiar manner; 10) future trends should be

studied and plans should be prepared in the organization. After determining the organization's policy, plans must be made to provide guidelines for work to be according to the policy; 11) consideration should be given to separating work categories, organizing work groups and designing work for personnel by specifying clear scopes of work and assignments including specifying clear responsibilities, authority and duties; 12) performance should be governed and monitored and real results should be compared with specified goals. If real performance deviates from goals, adjustments have to be made to be consistent with goals in order to achieve the organization's objectives; 13) subordinates should be treated with care, attention to well-being and comfort. In addition, working conditions should be improved to be good with sincerity and justice for all subordinates; 14) personnel should be encouraged and supported to work successfully according to goals. Assignments shoul be interesting and challenging in order for personnel to be satisfied with work; 15) privacy policies should be made to give personnel good feelings with safety for personal data (PDPA); personnel should be encouraged and supported to have secure and sustainable occupations including confidence, love and organizational commitment; 17) estimates should be made concerning work exits and entries by personnel. In addition, target groups should be specified to seek expertise, recruit, select, include, appoint and use data in order to plan development guidelines/methods; 18) policies should be made and methods, processes or activities should be found to retain personnel in the organization with happiness and organizational commitment; 19) personnel should be encouraged and supported to participate more in the organization's operations; and 20) personnel should be encouraged and supported to share in benefits in the organization including in terms of quantity, quality and sharing of benefits to the organization's personnel in order to increase love and commitment to the organization.

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