Information Technology Creativity and Economic Growth: A Case of Korea

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Abstract

This paper examines the contributing factors of information technology (IT) creativity and whether IT creativity can explain the economic growth in Korea. We empirically test college students' perception and attitudes on educational quality, work environment, social preparedness on tolerance, and government-initiated IT policy. We also test whether creative capital theory, which states creativity as the major driver ofregional and national economic development– is working in Korea. We apply structural equation modeling (SEM) to analyze the survey data collected from college students in five different regions in Korea. SEM analysis indicates that all endogenous constructs, except education quality, provide a statistically significant explanation of IT creativity and economic growth. The results found that government IT policy, work environment, and tolerance are essential indicators of IT creativity, and IT creativity also positively influences economic growth in Korea.

Keywords: Creativity, Information Technology, Economic Growth

1. Introduction

The development of innovative information technology (IT) products and services is considered as amajor driver of regionaland national development and economic growth in the current competitive business environment. Likewise, regions and nations increasingly seek to improve their creative and innovative IT capability to enhance their economic growth. Battles among regions and nations to preoccupy new innovative IT products and services have been intensified as we have witnessed from the recent conflicts between the United States and China with 5G network technology.

As the importance of innovative IT products and services for regional and national growth is emphasized, the need for IT creativity, the fountainhead of IT innovation (Amabile, 1988), at the level has increased. Florida (2002) argues that creativity is a major contributing force to the competitiveness of regions and nations. He ranked different countries using a creativity index and found that the rankings correlated closely with the results from the studies of international competitiveness. However, IT creativity at the regional and national levels has received relatively little attention from information systems (IS) researchers. IS studies primarily focused on the use of specific IT (e.g., creativity support systems) on the creativity at individual and group levels (Muller and Ulrich, 2013; Seidel et al., 2010) and the individual, group, and organizational factors on the creative processes of group IS development (Cooper, 2000; Tiwana and McLean, 2005). IS studies on creativity at higher levels are necessary (Seidel et al., 2010).

This study examines the contributing factors of a nation's IT creativity and whether IT creativity leads the nation's economic growth. In the following sections, we propose a research model and hypotheses and test the hypotheses using structural equation modeling (SEM) using the data collected from a nation. Thereafter, we discuss the results of the analysis and the limitations of this study.

2. Theoretical Development

This section examines the theoretical domain of creativity and develops a research model and hypothesis based on creative capital theory. In his creative capital theory, Florida (2002) argued that there is a class of people called creative class in any country and defined a creative class as the creative and talented professionals whose economic function is to create new ideas, new technology, and/or creative content. He pointed out that in the knowledge-based economy, regions and nations can gain an advantage by mobilizing the creative class available and that creative and talented people are a major contributing force to the economic growth of regions and nations.

Based on the creative capital theory, organizational behavior and regional growth literature viewed that the concentration of creative class and the formation of a social environment favorable to these people are the important factors for regional and national IT creativity and, consequently, economic growth (Hansen et al., 2005; Sleuwaegen and Boiardi, 2014; Wood et al., 2011). Based on the organizational behavior and regional growth literature, this paper identifies education quality, tolerance, work environment, and government IT policy as the indicators of IT creativity.

A suitable research model is developed to show how the four factors are related to IT creativity and also the relationship between IT creativity and economic growth. The research model is presented in Figure 1, and the associated hypotheses are elaborated.

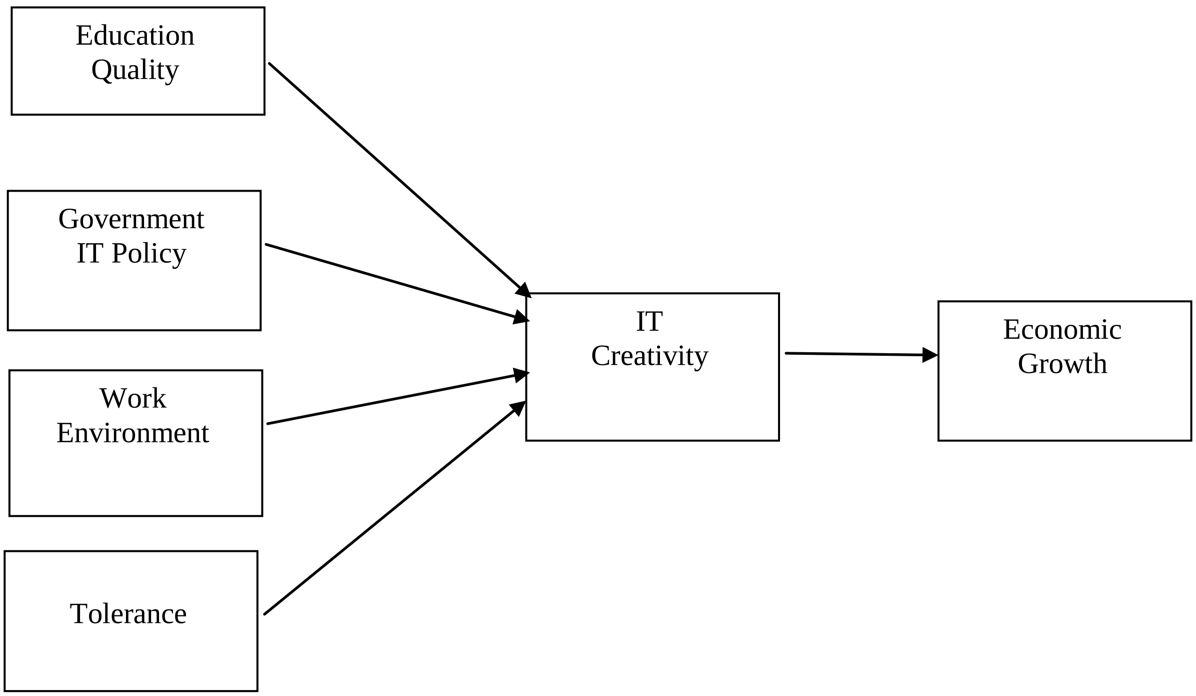


Figure 1. Research Model

2.1. Education Quality

Literature in regional growth has used education as a proxy for creative and talented people. According to Glaeser (2004), creative and talented people can be measured by educational attainment because most members of the creative class are skilled and highly educated. Florida (2002) created a talent index that counts talented people and used education as a leading indicator of global talent flows. Feldman (2001) points out that highly educated people tend to produce more creative ideas that nurture the development of industries and lead to regional economic and population growth. Holbrook and Clayman (2003) emphasize that education plays a vital role in generating creative skills and research in regions. Rodríguez-Pose and Crescenzi (2008) demonstrate that the proportion of people with tertiary education serve as an important indicator in explaining the creativity of regions. The tertiary education institutions contribute to developing creative students (Fields and Atiku, 2015), and how the presence of tertiary institutions in a region can boost its creativity potential has been underscored in regional growth literature (Sleuwaegen and Boiardi, 2014).

H1: Education quality is positively associated with IT creativity.

2.2. Work Environment

The work environment usually refers to the resources and climates necessary to do tasks (Nieves & Quintana 2018). Uwandia (1990) classified the work environment with respect to creativity into three categories: individual, organizational, and technical environment. The individual work environment focuses on the distinctive individual characteristics associated with creative behavior. Motivation and knowledge are widely recognized as important individual elements of creativity (Amabile and Pratt. 2016). The organizational environment focuses on organizational practices and managerial actions that beneficial or detrimental to creativity. It includes management and leadership, resources such as time and money, and organizational structure and systems (Blomberg et al., 2017).

The organizational environment influences employees' creativity by providing freedom and autonomy, appropriate resources, hierarchical or loosely structured working environment (Blomberg et al., 2017).

The technical environment focuses on the technical resources needed for creativity. It includes physical IT facilities, information resources such as databases and knowledge bases, and communication tools (Olszak and Kisielnicki). In addition, the human capital theory argued that the location of working place is the key to attract creative and talented people (Florida 2002). Regions with a great number of highly educated and skilled people attract more creative and talented people because they can have intimate interactions with those people and increase their own knowledge (Boschma and Fritsch, 2009).

H2: Work environment is positively associated with IT creativity.

2.3. Tolerance

Tolerance refers to the openness to people with diverse demographic backgrounds and openness to experience and is considered a key determinant of IT creativity (Hansen et al., 2005; Groyecka, 2018). Openness is a predictive trait for creativity measures such as creative thinking, everyday creative behaviors, and creative achievements (Silvia et al., 2009). A region or nation with a high level of tolerance for a wide range of people attracts more talented people (Florida and Gates, 2002). Florida and Gates (2002) developed the gay index as a proxy for tolerance and used openness to gay communities as an indicator of the low entry barriers to creative and talented people that are important to generating creativity. They found that the gay index is positively and significantly associated with the ability of a region both to attract creative and talented people and to generate high-tech creativity. Therefore, tolerance is critical to attract creative people and stimulate creativity across various people in the regions and nations. Key elements in achieving IT creativity are creating a general climate of openness and fostering immigrant-rich, creative regions (Florida, 2005). Increased tolerance also leads to lower levels of risk aversion, promoting a more robust evaluation and acceptance of novel ideas related to IT (Latimer, 1998).

H3: Tolerance is positively associated with IT creativity.

2.4. Government IT policy

Government IT policy in this paper refers to government policy factorable to the IT industry. It includes whether government provides enough incentives to private organizations to encourage research and development in the IT area and invests enough financial resources inthe IT sector and growing IT human capital. Such government IT policies are an obvious way to stimulate and motivate IT creativity (Byron and Khazanchi, 2012). Government policy in IT investment has been regarded as a critical strategy to improve IT potential andIT creativity in regions (Bilbao-Osorio and Rodríguez-Pose, 2004). Government incentive policy encourages motivation in creative IT development in individuals, organizational, and industrial levels and improves their creative process and thus creative performance (Erat and Gneezy, 2016). Florida (2005) calls for complementing policies for attracting firms with policies for attracting people.

H4: Government IT policy is positively associated with IT creativity.

2.5. IT creativity and Economic Growth

The major theme of creative capital theory is the contribution of creativity to economic growth at the regional and national levels. Instead of a direct association between them, the studies have used the concentration of creative class in a region as a determinant of regional economic growth (Correia and Costa, 2014). Likewise, the contribution of IT creativity to economic growth needs to be considered in terms of perceived IT innovative performance, such as perceived performance of IT innovation and investment at the regional and national levels (Lin and Liu, 2012). Isaksen et al. (1999) asserted that IT creativity nurtures the generation and use of new IT products and services because IT creativity supports the development, assimilation, and utilization of new and different approaches related to IT. Sleuwaegen and Boiardi (2014) underscored to recognize the importance of IT creativity in fostering innovation and viewed IT innovation as enablers of business development and, ultimately, economic growth. By reviewing a decade of IS studies at the firm and the country level, Dedrick et al. (2003) found that IT investment is associated with productivity growth at both the firm and country levels.

H5: IT creativity is positively associated with economic growth.

3. Methodology and Results

We collected data through a self-administered questionnaire from 612 college students from 5 universities in five different cities in Korea. Because our research model investigates the relationships between latent constructs, we used structural equation modeling (SEM) with AMOS to test whether our model was supported by the data and evaluate our hypotheses. The data analysis consists of two steps: first, confirmatory factor analysis (CFA) was performed to test the validity and reliability of underlying latent constructs; second, the hypothesized research model was tested.

3.1. Analysis and Results of the Measurement Model

We developed a measurement model for the instrument, consisting of 6 latent constructs and 23 observed variables. To ensure the observed variables in the measurement model form strong unities to latent constructs and demonstrate good measurement properties (i.e., construct validity and reliability), factor and reliability analyses are most frequently used (Straub, 1989). A graphical representation of the CFA results is presented in the Appendix. The summary of CFA results in Table 1 shows that the factor loadings for all six latent constructs are statistically significant at 0.001 level and range from 0.44 to 0.89. The magnitude and significance of the factor loadings suggest that all indicators were moderately or strongly correlated with their latent constructs. Each construct's Cronbach's alpha in the measurement model was calculated using its factor loadings and standard error values to assess the construct reliability. A general rule for Cronbach's alpha is that above 0.6-0.7 indicates an acceptable level of reliability (Gefen et al., 2000). The reliabilities of the five latent constructs (i.e., Education Quality, Government IT Policy, Work Environment, Tolerance, IT Creativity, and Economic Growth) range from 0.77 to 0.92, as depicted in Table 1, which are above the recommended threshold range of 0.6-0.7.

Table 1. Parameter Estimates, Construct Reliability, and Model fit Statistics of the Measurement Model

Constructs	Parameters	ML Estimate	t-Value*	Reliability
Education Quality (EQUAL)	EQ1	0.52		
	EQ2	0.65	7.78	0.77
	EQ3	0.50	7.44	
Government IT Policy (GP)	POL1	0.56		
	POL2	0.57	10.18	
	POL3	0.74	11.57	0.86
	POL4	0.70	11.39	
Work Environment (WE)	WRK1	0.80		
	WRK2	0.66	16.93	
	WRK3	0.79	20.98	0.92
	WRK4	0.78	20.92	
	WRK5	0.77	20.43	
	WRK6	0.79	21.17	
Tolerance (TOL)	TOL1	0.50		
	TOL2	0.65	20.45	0.92
	TOL3	0.58	20.45	
IT Creativity (ITC)	CRE1	0.51		
	CRE2	0.61	9.71	
	CRE3	0.79	10.38	0.80
	CRE4	0.55	9.16	
Economic Growth (EC)	GRW1	0.44		
	GRW2	0.89	10.81	0.83
	GRW3	0.89	10.82	
Measures of Model Fit χ^2 = 635.81 (df = 217; p <0.01); χ^2/df = 2.93 GFI = 0.914; AGFI = 0.891; CFI = 0.913; RMSEA = 0.056				

The first item of indicator estimate in each construct is fixed at 1.00 and does not have a t-value.
** All t-values are significant at p < 0.001.*

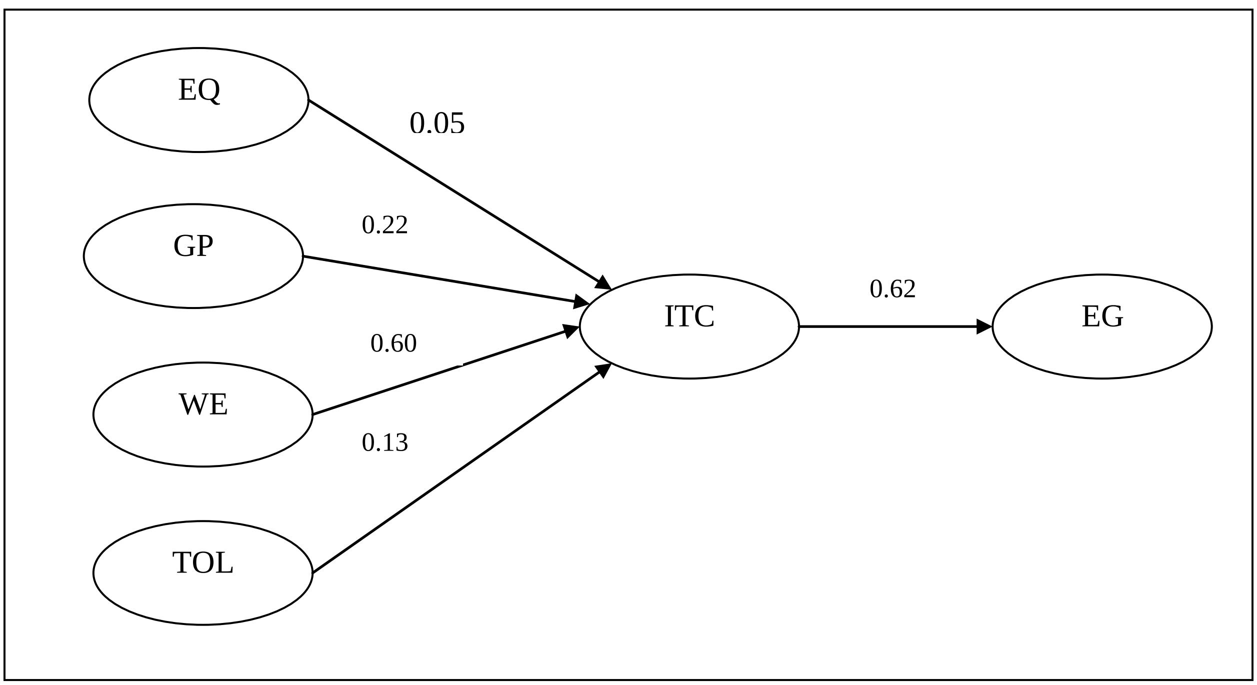
The measures of model fit indicate sufficient congruence between observed and model-implied covariance matrices. Because there is no clear consensus on a single or a set of measures to assess fit, IS literature reports different sets of measures. This paper reports the fit measures used in widely cited SEM studies in IS (i.e., Doll et al., 1994; Gefen et al., 2000; Devaraj et al., 2002). They are observed χ^2, goodness-of-fit (GFI), adjusted goodness-of-fit (AGFI), comparative-fit-index (CFI), and the root mean square error of approximation (RMSEA). Values greater than 0.90 for CFI and GFI indicate a good fit (Gefen et al., 2000), but the values are acceptable if above 0.8 (Baumgartner and Homburg, 1996; Doll et al., 1994). AGFI value greater than 0.80 and RMSEA less than 0.10 suggests a good fit (Devaraj et al., 2002).

As shown in Table 1, the observed χ^2 for the measurement model is 635.81 (df = 217, p <0.001). The GFI, AGFI, CFI, and RMSEA are 0.914, 0.891, 0.913, and 0.056, respectively.

Adjusting for degrees of freedom, the normed value of χ^2 is 2.93. Both the normed value of χ^2 and fit indices indicate that the measurement model is a good-fitting model. The magnitude and significance of factor loadings, the Cronbach's Alpha measures, and model fit indices all indicated that the measurement model contains valid and reliable constructs, and thus, we retained the proposed measurement model to test the hypotheses proposed.

3.2. Analysis and Results of the Hypothesized Research Model

The SEM analysis was used to assess the relationships between endogenous and IT creativity and economic growth constructs in the hypothesized research model (i.e., structural model). The path coefficients and fit indices are listed in Table 2. The observed χ^2 for the model is 755.29 (df = 221, p < 0.001). The GFI, AGFI, CFI, and RMSEA are 0.902, 0.877, 0.889, and 0.063, respectively. Adjusting for degrees of freedom, the normed value of χ^2 is 3.42. All fit indices and the normed value of χ^2 indicate that the hypothesized research model is a good-fitting model. Figure 2 presents a graphical representation of the model with path coefficient (β) for each construct. As shown in Table 2 and Figure 2, all path coefficients are statistically significant at the 0.05 or 0.001 level. The values of path coefficients range from 0.15 to 0.62. SEM analysis shows that except education quality, government IT policy, work environment, and tolerance are significantly associated with IT creativity at the 0.001 or 0.05 level, and IT creativity also is significantly associated with economic growth at the 0.001 level. Therefore, H2, H3, H4, and H5 were supported, but H1 was not supported.



[a] The λs and δs are omitted for schematic simplicity

Figure 2. Hypothesized Research Model Showing Path [a]

Table 2. Path and Fit Indices for the Hypothesized Research Model

Path	Coefficient (β)	t-Value
Education Quality (EQ) → IT Creativity (ITC)	0.05	0.99***
Government IT Policy (GP) → IT Creativity (ITC)	0.22	4.46*
Work Environment (WE) → IT Creativity (ITC)	0.60	8.61*
Tolerance (TOL) → IT Creativity (ITC)	0.13	2.32**
IT Creativity (ITC) → Economic Growth (EG)	0.62	5.72*
Measures of Model Fit χ^2 = 755.29 (df = 221; p < 0.001); χ^2/df = 3.42 GFI = 0.902; AGFI = 0.877; CFI = 0.889; RMSEA = 0.063		

* indicates p < 0.001; ** indicates p < 0.05, *** indicates p > 0.05

Cohen (1988) provides recommendations for path coefficient interpretation in social science. Standardized path coefficients with absolute values less than 0.10 indicate a "small" effect; values around 0.30 a "medium" one; and values of 0.50 or more indicate a "large" effect.

Based on his recommendation, the structural model as illustrated in Figure 2 shows that work environment (β = 0.60), government IT policy (β = 0.22), and tolerance (β = 0.13) have an impact on IT creativity with large, medium, and small effect sizes, respectively. IT creativity (β = 0.62) shows large effect on economic growth.

4. Discussion and Conclusions

This paper examined what determines IT creativity in Korea and whether IT creativity and resulting IT innovation can explain Korean economic growth in recent decades, based on the college students' perception. The indicators to IT creativity we investigated were education quality, government IT policy, work environment, and tolerance. The findings of this study complement and contradict the previous studies on the topic and revealed interesting information.Among the four IT creativity indicators, government IT policy, work environment, and tolerance were statistically significant, but education quality was not. The creative theory states that talented people are the major driver of creativity (Florida, 2002), and the creativity studies in regional economic growth have used education as a proxy for the talent (Hansen, et al., 2005; Kloudová and Chwaszcz, 2012). But Florida (2002) argued that educated people are not necessarily creative people. This paper found that Florida's (2002) argument is needed to be more investigated, and further researches can be performed on how to measure talented people with respect to creativity.

Another finding of this paper is the large and medium effects of the work environment and government IT policy. The work environment usually refers to the resources and climates necessary to do tasks (Nieves & Quintana 2018). This paper supports that the psychological (e.g., motivation), informational (e.g., knowledge), physical (e.g., technology), and managerial environments together at the workplace are important (Amabile and Pratt. 2016; Cooper, 2000; Nieves & Quintana 2018). Government policy can be more beneficial for IT creativity and innovation due to the high levels of uncertaintyrelated to investments in technological development and the rise to a situation of market failure (Dolfsma and Seo, 2013). The significant association of tolerance with IT creativity confirms that openness to people with diverse demographic backgrounds is also a key determinant of IT creativity (Hansen et al., 2005). The interesting finding is the relatively smaller effect size of the tolerance than expected. The discrepancy may originate from the limited scope of tolerance which is considered only people's diverse demographic backgrounds. The considerations of more dimensions of tolerance, such as openness to functional areas (e.g., business, arts, engineering, geography) and intellectual capability (Bassett-Jones, 2005), will contribute to a better understanding of tolerance on IT creativity. Lastly, this paper also found that IT creativity and its resulting IT innovation are one of the major contributors to the economic growth in Korea. The finding is congruent with the fact that IT-related products such as smartphones and electronics have occupied a significant portion of Korean export.

This study has limitations with data collection. The sample subjects are college students, and the research model was assessed based on the students' perceptions. Although this fact may not adversely affect this study's findings, there is no question that the results of this study could be enhanced by collecting data from the subjects in IS fields or more diverse populations.

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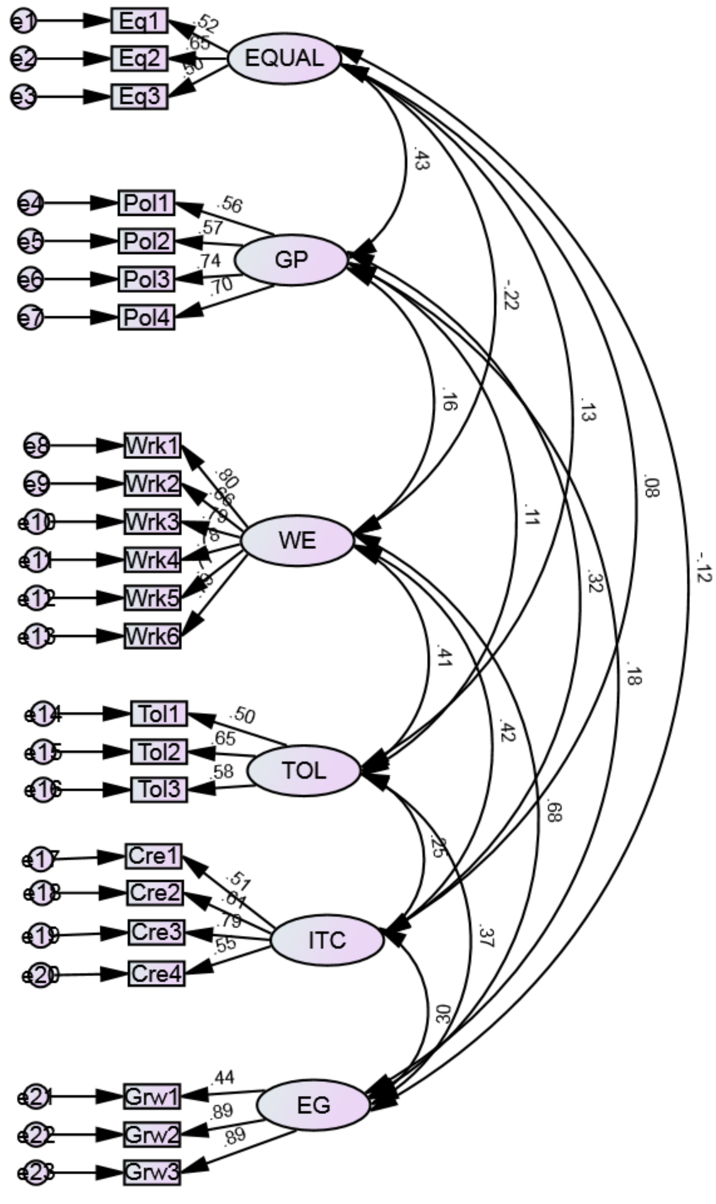
Appendix: The Results of Confirmatory Factor Analysis- The Measurement Model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