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조직 내 정보시스템의 양면적 사용

Ambidextrous Use of Information Systems in an Organization

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요 약

조직의 양면성은 일반적으로 경쟁적 시장에서 생존하기 위해 중요한 조직적 혁신을 가능하게 하는 유연성으로 해석된다. 정보시스템 사용자의 탐색적 혹은 활용적 사용의 양면성이 역동적 혹은 운영적 작업 간에 유연한 전환을 가능하게 하여 결과적으로 작업성과를 높이는 데 기여하게 된다. 본 연구는 개인 수준에서의 정보시스템 사용 양면성의 보완적 적합성이 업무 성과를 향상시키는지 검증하고자 하였다. 나아가 이 둘이 양면적 사용에서 차지하는 비중에 따라 업무의 유형에 따른 성과에 기여하는지도 알아보았다. 다항적 회귀분석과 표면분석을 통해 정보시스템 사용 패턴의 부조화적 적합성의 효과를 확인하였다. 이를 확산적 양면성과 수렴적 양면성으로 분류하고 각 패턴의 효과는 작업의 역동적 혹은 운영적 유형에 따라 다르게 나타남을 확인하였다.

키워드 : 양면성, 탐색적 시스템 사용, 활용적 시스템 사용, 적합성, 적응, 운영

Ⅰ. Introduction

The patterns of IS use, particularly adaptive use of IS, are now attracting growing attention from professionals and scholars (Bala and Venkatesh, 2015; De Guinea and Webster, 2013; Schmitz *et al.*, 2016; Stein *et al.*, 2015; Sun, 2012). This is especially true in the current, turbulent business environment where strategic use of IS is vital (Arvidsson *et al.*, 2014). In other words, it is important that research is focused on how IS should be used to enhance the success of an organization rather than what IS should be adopted.

The huge potential of IS results from the possible combinations of its numerous functions. For example, functions delivered through applications or menus inside a system are designed to enable all the work performed in an organization. The resulting system is regarded as a conglomerate of basic modules, each of which delivers corresponding functions and is derived to achieve an organizational goal. Modules can be a unit of software, application, or menu. They implement business processes which are decomposed from each department's requirements. However, they are designed not only to accomplish the current goal of an organization

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in the current market conditions but also to sustain the organization whenever disruptive change is necessary. The market is rapidly changing; harsh competition requires a company to pursue innovation which often demands the replacement of existing products and routines. This naturally results in organizational change or, at the minimum, the change of routine business processes.

Ideally, information systems are designed to enable any combination of any modules. The sheer number of possible combinations of modules in a system can be considered to be an expression of the flexibility of the system. The flexibility of IS is often invisible behind the front-end functions utilized by employees. Even though employees are trained in the extensive span of IS functions, the depth of that training is not retained when they get busy and go back to their daily work. The few functions utilized in any one employee's daily tasks are limited compared to those constructed when the system is designed. Arvidsson *et al.* (2014) call it "outcome strategy blindness: organizational incapability to realize the strategic intent of implemented, available system capabilities". A well-designed system includes functions that manage almost every situation that can occur in an organization. This can even include the change of organizational structure or addition of a new business.

"Ambidextrous IS use" is defined as the adaptability to fully utilize IS flexibility in an ambidextrous organization. Worker adaptability is important to an organization's sustainability in a competitive market of highly connected business ecosystems (Bala and Venkatesh, 2015; Hallen *et al.*, 1991; Levinthal, 1991). However, adaptability incurs trade-offs with expertise. Experts are more cognitively entrenched than novices (Schmitz *et al.*, 2016; Sun, 2012). They conform to the experienced knowledge and specialty routines, which result in fewer innovative or creative solutions (Dane, 2010). Experts in a domain may not try to search outside their domain, even when it is necessary to pursue innovation in a dynamic environment (Lewandowsky *et al.*, 2007). This applies the same way to IS use. When employees are accustomed to their work and the allied IS, they are experts in their work. They do not intend to explore the system further; they simply repeat their system routine until forced change occurs. This usually occurs in the form of external disruption, such as new product development. When employees are confronted with disruptive change, they must be able to adapt to the new business process. This can be a new skill in and of itself.

"Adaptable capability in IS use" refers to the ability to find the right pattern of IS use that fits the task at hand, especially when the work is composed of a mixture of type of work. There are two well-known types of work in an organization: explorational and exploitational work. In terms of task-technology-fit theory, for the explorational task, employees are expected to explore IS to find undefined solutions for a problem (Liang *et al.*, 2015). For exploitational work, which is expected to generate clear outcomes, IS should enable employees to find the expected outcome (Kane and Alavi, 2007). Specifically, exploitational use of IS means using a certain fixed combination of modules repeatedly throughout a task. Explorational use, meanwhile, means exploring module by module to find the best combination which produces the best outcome for unstructured and innovative tasks.

Therefore, in the present study, both explorational and exploitative IS use are considered and the complementary relationship between them is investigated. Specifically, the differential influence of exploratory and exploitative IS use on dynamic and operational work is evaluated.

Ⅱ. Theoretical Background

2.1 Adaptive Use of IS

The technology acceptance model has focused on the early state of technology adoption (Davis, 1989; Venkatesh and Davis, 2000), but this has shed little light on the adaptive use of IS (Bernstein and Nunnally, 1994; De Guinea and Webster, 2013; Sun, 2012). Which pattern users choose in which conditions, and in which conditions different patterns are more effective, for example, have rarely been studied (Serrano and Karahanna, 2016; Walsh *et al.*, 2016). By considering this, it is possible to understand how the right choice of use pattern will impact a worker's performance and eventually the efficiency of the organization (De Guinea and Webster, 2013; Iyengar *et al.*, 2015; Stein *et al.*, 2015; Sun, 2012). Most research still regards IS as a black box; however, only the adoption of technology is considered to influence the exploration or exploitation level, which determines the organizational performance as a whole (Kane and Alavi, 2007). For instance, in a study where the technological capability has been found to influence exploitation at an increasing rate but exploration at a decreasing rate, the potential of different patterns of use with the same IS was not considered (Zhou and Wu, 2010). However, the same study also validated that strategic flexibility will moderate the effect of IS on the exploration so that it allows for enhancement of exploration. For instance, in most situations, a banker uses their systems to process money transfers without an issue. When a transfer fails, however, they need to explore the system to find out why. The latter task is very rare, but it is both critical to the bank's reputation and complex to resolve. The banker will try to think of all possible cases and try to simulate them with system features with which they are unfamiliar. Some will use it exploitatively by simply complying with their training, while others will use it exploratively, searching out new features or learning how to complete new tasks. In general business practice, however, it is likely that people use both the exploration and exploitation of IS simultaneously and according to the task at hand which we call "ambidextrous IS use".

The concept of adaptive use of IS is based on the fact that the use of a certain IS is not fixed. For the adaptive use of IS, people are switching from automatic thinking to active thinking by switching cognitive gears when certain conditions are set (Louis and Sutton, 1991). Users adaptively revise their use of IS based on novel situations, discrepancies, and deliberate initiatives. There are four sub-dimensions of these revisions: trying new features, feature substituting, feature combining, and feature repurposing (Sun, 2012). de Guinea and Webster (2013) assert that IS use has two patterns－adjusting use and automatic use－that affect each other depending on the stages of adoption; the automatic use only increases short-term performance. Adaptive patterns of IS use can also cause ambivalent emotions when an employee begins to use the new IS, and hence, a vacillating strategy that deals with ambivalent emotion by combining different adaptation behavior has led to observations of task and tool adaptation behavior and improvisational use patterns, such as exercising discretion or personalization, which, in turn, leads to positive engagement and performance (Stein *et al.*, 2015). In studies that follow this theme, two patterns of IS use have been proposed: the exploitative type of IS recomposition, in which proposed technological capabilities are a means to obtain better performance, and the exploratory type of IS recomposition, in which proposed technological capabilities are a means to problem solving, personal development and growth (Nevo *et al.*, 2016).

The adaptive use of IS is like that of knowledge

workers who choose independently when and how to apply their discipline and passion to enhance product development (Andriopoulos and Lewis, 2009). Further, systems designed to provide options to choose or elicit the right pattern of use depending on the type of dynamic or operational work will allow employees to achieve organizational goals through increasing productivity. This study could give new insight into how organizational systems should be designed and developed.

2.2 Ambidextrous IS Use

Organizational learning which determines strategic orientation and performance in corporations has two basic patterns (March, 1991). The first pattern is exploratory IS use, which is innovative and uses external search, integration, global adaptation, and the flexible process of innovation. The second pattern is exploitative IS use, which is incremental and internal search, automatic procedure, local adjustment, and an operational efficiency (Mithas and Rust, 2016). Google is an example of an ambidextrous organization such that employees are working on exploratory or innovative projects of their own 20% of the time, while completing exploitative or operational work in the form of corporate projects 80% of the time (Csaszar, 2013).

In an ambidextrous organization, explorational and exploitative work co-exist (Andriopoulos and Lewis, 2009; Burgelman, 2002; Gupta *et al.*, 2006; Raisch and Birkinshaw, 2008). For instance, innovative endeavors such as R&D and operational routines such as manufacturing or human resource management take place at the same time. The more ambidextrous an organization is, the more it can adapt to changing conditions. The same can be said of individual employees in each department. They should work ambidextrously by balancing their explorational and exploitative work.

In terms of IS use patterns, some studies have begun implementation, validating that there are different use patterns in different conditions and with different effects (Sun, 2012). The way to use IS changes depending on the task at hand. Such use patterns are also called operational work vs. creative work, process-driven vs. innovation-driven (Adler *et al.*, 1999), or search depth vs search scope (Katila and Ahuja, 2002).

In this study of IS use patterns, we applied the concept of ambidexterity (using both exploration and exploitation patterns) from organization studies to individual users of IS in an organization. IS use cannot be disaggregated from the work itself in an organization (Stein *et al.*, 2015). That is, if an organization is ambidextrous, the IS should also be aligned to be ambidextrous (Leonhardt *et al.*, 2017). Workers in an organization and the systems are interrelated; each changes the behavior of the other (Leonardi, 2011). The concept of ambidexterity, therefore, is critical in both IS use and organizational processes. This study identifies how ambidextrous IS use directly relates to the differential measures of performance and how the exploration and exploitation patterns of IS use complementarily interact with each other.

Drawing on the concept of ambidexterity, it can be argued that there is a relationship between exploration and exploitation, and operational or dynamic work. The work requiring an individual's operational capability will need their exploitative use of IS while the work requiring an individual's dynamic capability will need their exploratory use of IS. Even though the individual may switch back and forth between the two types of IS use patterns during their work, we presume that the primary IS use pattern will be determined by the type of task.

In the IS use pattern, this study assumed the complementary incongruence where, for certain types of work (i.e., dynamic vs. operational), more exploration in the

ambidextrous spectrum will increase proactive or adaptive performance (i.e., diverging incongruence), while more exploitation in ambidexterity will increase the proficient performance (i.e., converging incongruence). Employees should be transitional from explorational IS use to exploitation IS use, or vice versa, which will result in complementary incongruence of ambidextrous IS use. That is, exploration and exploitation should exist simultaneously but in different proportion depending on the type of work in front.

Therefore, individuals working in an ambidextrous organization need to have the transitional capability to alternate between exploration and exploitation, and hence, we propose that IS users should have capability to shift freely between exploratory vs. exploitative IS use in order to enable work and organization ambidextrous. The validation of the transitional effect of IS use patterns will suggest how IS should be designed for the future. In the current study, we employed the measurements of IS exploration and IS exploitation from the survey items used in Bala and Venkatesh (2015).

2.3 Performance Outcomes

In an organization, tasks are composed of dimensions of proficiency, adaptability, or proactivity (Griffin *et al.*, 2007). Previous studies on the impact of IS on task performance have focused on operational performance such as proficiency (Benner and Tushman, 2003; Cao *et al.*, 2009; Lee *et al.*, 2015). However, outstanding performance often needs creative, proactive, or innovative capabilities to solve new, complex, or challenging problems that do not occur in a daily basis but might have huge impact on the organization when it is done right (Taylor and Greve, 2006; Teece, 2007). We believe that operational type of work such as proficient job will be best performed whit exploitative IS use and dynamic type of work such as adaptive and proactive job will be best performed with exploratory IS use. The fit between task type and IS use pattern will show how incongruence of ambidexterity influences work performance. Work performance measures of proficiency, adaptability, and proactivity are come from Griffin *et al.* (2007).

Ⅲ. Hypotheses

Before testing the role of complementary incongruence in ambidexterity, primary hypotheses regarding the effect of IS use exploration and IS use exploitation on performance were developed. It is likely that each process will have a different effect; exploitation will increase operational capability such as proficiency while exploration will increase adaptational capability such as adaptability and proactivity. IS use for exploration or exploitation is aligned with business strategy of exploration or exploitation (Gerow *et al.*, 2015)s. Task-technology fit theory (Goodhue and Thompson, 1995) also ascertains IS should be aligned with the corresponding task at hand, and hence, the performance would be improved through the IS. In the same logic, information system should be designed to be easy to navigate and explore new knowledge or to be easy to focus and complete the exploitative work. There is rare research on exploratory and exploitative use of IS even though both processes are heavily studied in organization and strategy discipline mostly drawn on March's (1991) study of organizational learning. Exploratory process is commonly known to be necessary to innovation and rapid change in organizations and exploitative process are linked to operational and routine job of organizations (Lee *et al.*, 2015).

H1a: IS use exploitation will increase proficiency more than IS use exploration will.

H1b: IS use exploration will increase adaptivity more than IS use exploitation will.

H1c: IS use exploration will increase proactivity more than IS use exploitation will.

The IS use ambidexterity in performance will present a complementary relationship between operational capability (i.e., proficiency) and dynamic capability (i.e., adaptability and proactivity). Exploitative use of IS will have a positive effect on operational capability. The impact will increase in concave while the converging incongruence is increasing. Exploratory use of IS will have a positive effect on adaptive and proactive capability and the increase will occur in concave while the diverging incongruence is increasing. Converging ambidexterity refers to complementary fit (incongruence) where exploitation posits a gradually increasing ratio in a certain state of ambidexterity. For instance, when users exploit IS more than they explore it, this is called converging ambidexterity of IS use.

The converging ambidexterity in which exploitative IS use is greater than exploratory IS use will increase the operational capability in a concave relationship where the improvement of operational capability will have a peak point after a certain duration of time and it will become slow and moderate (De Guinea and Webster, 2013).

H2a: In IS use ambidexterity, proficiency will increase when IS use exploitation is greater than IS use exploration.

On the contrary, diverging IS ambidexterity means the proportion of IS exploration exceeds IS exploitation. It is hypothesized that when workers need to complete adaptive or proactive work, they will use the IS exploratively, adapting to the work at hand. When they work on innovative or creative tasks without an exact answer or structure, they also need to use IS in a new way different from the way they previously used it. Diverging ambidexterity refers to complementary fit (incongruence) where exploration posits a gradually increasing ratio in a certain state of ambidexterity. For instance, when users explore IS more than they exploit it, and as the proportion of exploration surpasses exploitation, the state of diverging ambidexterity of IS use occurs. The diverging ambidexterity will increase the dynamic capability. Specifically, the exploratory IS use will increase dynamic capability in a concave relationship (Zhou and Wu, 2010). The improvement of dynamic capability will have a peak point after a certain duration of time. It will then become slow and moderate.

H2b: In IS use ambidexterity, adaptivity will increase when IS use exploration is greater than IS use exploitation.

H2c: In IS use ambidexterity, proactivity will increase when IS use exploration is greater than IS use exploitation.

IV. Method

An online survey was used to recruit participants who are employed in companies with various jobs: sales (13%), engineering (2%), administration (55%), management (8%), professional (23%), and government (1%). Three hundred employees responded to the survey: 49% (147) male and 51% (153) female. Of the participants, 29% (87) were between 20~29 years of age, 50% (149) were between 30~39 years of age, 15% (46) were between 40~49 years of age, 5% (16) were between 50~59 years of age, and 1% (2) were 60 years of age or older. The measurements included in the survey were: IS exploration, IS exploitation, task performance of proficiency, adaptability, and proactivity.

〈Table 1〉 Descriptive Statistics and Intercorrelations

Variables	M	SD	1	2	3	4	5	6	7	8	9	10	11	12
1. Industry-IS	.16	.37	-											
2. Industry-Service	.32	.46	.29***	-										
3. Firm size	.34	.47	-.04	-.04	-									
4. Age	33.82	7.76	.02	-.01	-.03	-								
5. Job level	.58	.49	-.15**	.03	.02	-.48***	-							
6. Professional	.17	.37	-.05	-.08	-.12*	.03	.01	-						
7. Sales	.10	.30	-.14*	-.29***	-.03	-.10+	.07	-.15**	-					
8. IS exploration	4.51	1.20	.06	.02	.03	-.04	-.17**	-.09+	-.05	(.91)				
9. IS exploitation	4.91	.95	.03	-.04	.11*	-.08	-.01	-.08	-.07	.45***	(.84)			
10. Proficiency	5.35	.96	.03	-.04	.08	.02	-.14*	-.12*	-.13*	.34***	.39***	(.86)		
11. Adaptivity	5.01	.96	.05	.01	.05	-.07	-.06	-.00	-.07	.51***	.49***	.56***	(.84)	
12. Proactivity	4.61	1.12	.03	-.07	.12*	-.09	-.02	-.12*	-.06	.69***	.47***	.43***	.54***	(.88)

N = 300. Firm size: (1 = above 300 employees, 0 = others). Job level: (1 = non-manager, 0 = manager). Numbers in parentheses represent reliability. $^{+}p < .10$, $^{*}p < .05$, $^{**}p < .01$, $^{***}p < .001$.

〈Table 2〉 Polynomial Regression on Proficiency

Variables	Proficiency		
	Model 1	Model 2	Model 3
(Control variables)			
Linear terms			
IS use exploration		.17(.05)**	.22(.05)**
IS use exploitation		.14(.06)*	.16(.06)**
Polynomial terms			
IS use exploration^2			.26(.02)***
IS use exploration×IS use exploitation			-.11(.04)+
IS use exploitation^2			.16(.04)*
R^2	.26	.29	.37
ΔR^2		.03***	.08***
F	12.76***	12.48***	13.68***
Response Surface Tests			
Slope of the IS use exploration = IS use exploitation line ($a_1 = b_1+b_2$)			.34***
Curvature of the IS use exploration = IS use exploitation line ($a_2 = b_3+b_4+b_5$)			.15**
Slope of the IS use exploration = - IS use exploitation line ($a_3 = b_1-b_2$)			-.22
Curvature of the IS exploration = - IS exploitation line ($a_4 = b_3-b_4+b_5$)			.28***
Lateral of shift ($a_5 = -(b_2-b_1)/2(b_3-b_4+b_5)$)			-.03

Note: N = 300. IS= Information Systems. Numbers in parentheses represent standard errors of estimates. $^{+}p < .10$, $^{*}p < .05$, $^{**}p < .01$, $^{***}p < .001$.

Following Edward and Parry's recommendation, polynomial regression was conducted to be able to examine the (in)congruence effect (interaction effect) between two variables (i.e., X, Y) on outcome (i.e., Z) more elaborately (Edwards and Parry, 1993). To assess the hypotheses, firstly, the set of control variables were regressed on performance (i.e., proficiency, adaptive behavior, and proactive behavior). After creating the scale centered on higher order terms, five polynomial terms that are two linear terms (i.e., IS exploration and IS exploitation) and three higher order terms (i.e., the square term of IS exploration, the product term of IS and exploration and IS exploitation, and the square term of exploitation) were included in each equation. In accordance with Edwards and Parry (1993), the complementary fit effect can be observed when the following two conditions are satisfied: first, after imputing higher order terms in the equation, the explanation for the variation of the dependent variable should be significantly increased. Second, among the three higher order terms, at least one should have a significant regression coefficient. Based on these results, the complementary fit hypotheses (i.e., 2a, 2b, and 2c) were assessed by checking the following two conditions recommended by Edwards, Lee and Ferle (Edwards *et al.*, 2009). First, the slope (a_1) along the congruence line (Y = X) is positive and statistically significant. Second, the curvature (a_4) along the incongruence line (Y = -X) has a significantly negative value. When these conditions are satisfied, a three-dimensional graph shaped upward curvature along the incongruence line (Y = -X) results.

V. Results

<Table 1> shows descriptive statistics and correlation analysis among the study variables. As anticipated in this study, a significant correlation between IS exploration and IS exploitation was observed. Also, both of these variables are positively correlated to three types of performance, and the range of correlation is from .11 up to .71. description of the experimental results, their interpretation as well as the experimental conclusions that can be drawn.

To examine the hypotheses 1a and 2a, polynomial regression was conducted. The results are described in <Table 2>. In Model 1, the entire control variable set was imputed. In Model 2, the interaction term of IS exploration and IS exploitation was included to test the main effect, and in Model 3, the square term of IS exploration was also imputed. Results showed that both IS exploration (β = .17, p < .01) and IS exploitation (β = .14, p < .01) positively predicted proficiency (see Model 2 in <Table 2>). However, the difference score between the two coefficients was not significant (value = .03, p = n.s.) which means the size of the effect of each variable on proficiency is similar.

Thus, hypothesis 1a was rejected. Also, when the three higher order terms were included in the regression equation, the R square value was significantly increased (ΔR^2 = .08, p < .001, see Model 3). Simultaneously, the coefficient of the square term of IS exploration and the coefficient of the square term of IS exploitation were found to be significantly associated with proficiency (see Model 3). <Figure 1> illustrates the resulting three-dimensional graph, whereby both slope (a_1) along the Y = X (IS exploitation = IS exploration) line, and curvature (a_4) along the Y = -X (IS exploitation = -IS exploration) line had significantly positive values (a_1 = .34, p < .001, a_4 = .28, p <.001). These results lead to the conclusion that when both values of IS exploration and IS exploitation were more incongruent, proficiency is increased. By contrast, when both IS exploration and IS exploitation have the same value, this leads to a decrease in proficiency. However, along the Y = -X line, it was found that the lateral shift value (a_5 = -.01) did not differ from zero, which means

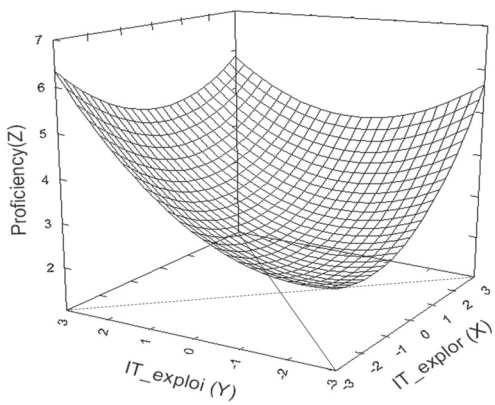
〈Table 3〉 Polynomial Regression on Adaptivity

Variables	Adaptive Behavior		
	Model 4	Model 5	Model 6
(Control variables)			
Linear terms			
IS exploration		.32(.04)***	.35(.05)***
IS exploitation		.32(.05)***	.19(.05)***
Polynomial terms			
IS exploration^2			.14(.02)**
IS exploitation×IS exploration			-.00(.04)
IS exploitation^2			-.05(.04)
R^2	.29	.41	.42
ΔR^2		.12***	.01+
F	13.75***	18.28***	15.17***
Response Surface Tests			
Slope of the IS exploration = IS exploitation line ($a_1 = b_1+b_2$)			.48***
Curvature of the exploration = IS exploitation line ($a_2 = b_3+b_4+b_5$)			.02
Slope of the IS exploration = - IS exploitation line ($a_3 = b_1-b_2$)			.08
Curvature of the IS exploration = - IS exploitation line ($a_4 = b_3-b_4+b_5$)			.03
Lateral of shift ($a_5 = -(b_2-b_1)/2(b_3-b_4+b_5)$)			-1.35

Note: N = 300. IS= Information and Systems. Numbers in parentheses represent standard errors of estimates.
+ $p < .10$, * $p < .05$, ** $p < .01$, *** $p < .001$

that even when the perfect incongruence effect was represented, the highest proficiency did not show in the specific side of the corner. Therefore, hypothesis 2a was rejected.

To test the hypotheses 2a and 2b, the same procedure as the above described analysis was adopted. The results are shown in <Table 3>. First, not only were both IS exploration (β = .32, p < .001) and IS exploitation (β = .32, p < .001) positively related to adaptive performance but also the two coefficients was not significantly different (value = .00, t = .00). This indicates the effect size of the two types of IS activities on adaptive performance was equal. Thus, hypothesis 2a was rejected. Hence, the polynomial equations (see Model 6) which included the three higher order terms have a marginal but significant value of change in R square (ΔR^2 = .10, p

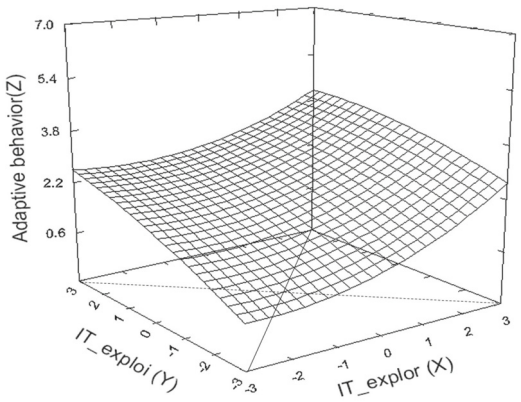


Note: X = IS exploration; Y = IS exploitation.
IT_explor = IS exploration;
IT_exploi = IS exploitation;
Solid line = congruence line (Y = X);
dashed line = incongruence line (Y = -X).

〈Figure 1〉 Surface Graph of the Fit between IS Use Pattern and Proficiency

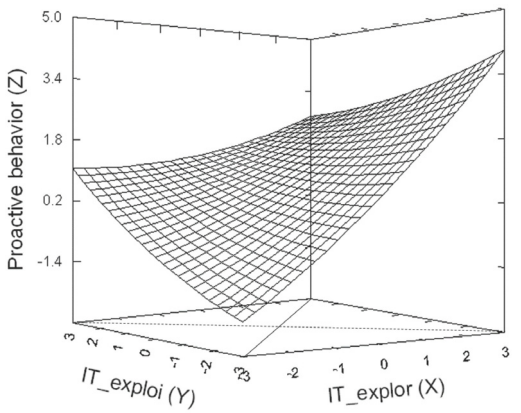
< .10). the coefficient of the square term of IS exploration (β = .25, p < .01) was also significant. Furthermore, as shown in <Figure 2>, from the response surface test, the slope of Y = X line was only significant (a_1 = .64, p < .001) but the slope and curvature of Y = -X were not significant (a_3 = .08, p = n.s.; a_4 = .03, p = n.s). These results suggest that only a linear relationship between the two IS activities and adaptive behavior was observed. That means when both IS exploration and IS exploitation are high, employees' adaptive performance is greater than when all are low (see <Figure 2>). Thus, the hypothesized complementary fit between IS activities on adaptive performance was not found. Moreover, the lateral shift value was negative (a_5 = -1.43), which implies the highest value of adaptive behavior was observed at the IS exploration side in the three-dimensional graph (see <Figure 3>). Therefore, hypothesis 2b was not supported.

To assess hypotheses 1c and 2c, the same procedure as the above described analysis was used. The main effects of the two types of IS activities on proactive behavior were found to be statistically significant (IS exploration: β = .59, p < .001; IS exploitation: β = .10, p < .05). Based on the result of the difference test of the two coefficients (value = .49, t = -5.89), the size of the effect of the two variables on proactive behavior was found to be different. That is, IS exploration has a stronger effect than IS exploitation as was expected, supporting hypothesis 1c. After imputing the higher order terms, the explanation of proactive behavior significantly increased and two of the coefficients for the higher order terms were significant (ΔR^2 = .02, p < .001, IS exploration: β = .09, p < .05; IS exploitation: β = -.18, p < .01; see Model 9 of <Table 4>). Moreover, the results of the response surface test showed that the slope of the congruence line (X = Y) and the curvature of the incongruence line (X = -Y) had significantly positive values (a_1 = .68, p < .001; a_4 = .22, p < .001). As depicted in <Figure 3>, a slight concave pattern was observed, and the lateral shift along the incongruence line had a negative value (a_5 = -1.05) which reveal that employees became more engaged in proactive



Note: X = IS exploration; Y = IS exploitation.
IT_explor = IS exploration;
IT_exploi = IS exploitation;
Solid line = congruence line (Y = X);
dashed line = incongruence line (Y = -X).

〈Figure 2〉 Surface Graph of the Fit between IS Use and Adaptive Behavior



Note: X = IS exploration; Y = IS exploitation.
IS_explor = IS exploration;
IS_exploi = IS exploitation;
Solid line = congruence line (Y = X);
dashed line = incongruence line (Y = -X).

〈Figure 3〉 Surface Graph of the Fit between IS Use and Proactive Behavior

〈Table 4〉 Polynomial Regression on Proactivity

Variables	Proactive Behavior		
	Model 7	Model 8	Model 9
(Control variables)			
Linear terms			
IS exploration		.59(.04)***	.61(.04)***
IS exploitation		.10(.05)*	.09(.05)+
Polynomial terms			
IS exploration^2			.09(.02)*
IS exploration×IS exploitation			-.18(.03)**
IS exploitation^2			.05(.03)
R^2	.37	.60	.62
ΔR^2		.23***	.02**
F	19.68***	39.95***	33.34***
Response Surface Tests			
Slope of the IS exploration = IS exploitation line ($a_1 = b_1+b_2$)			.68***
Curvature of the IS exploration = IS exploitation line ($a_2 = b_3+b_4+b_5$)			-.04
Slope of the IS exploration = - IS exploitation line ($a_3 = b_1-b_2$)			.46***
Curvature of the IS exploration = - IS exploitation line ($a_4 = b_3-b_4+b_5$)			.22***
Lateral of shift ($a_5 = -(b_2-b_1)/2(b_3-b_4+b_5)$)			-1.05

Note: N = 300. IS= Information Systems. Numbers in parentheses represent standard errors of estimates.
$^{+}p < .10$, $^{*}p < .05$, $^{**}p < .01$, $^{***}p < .001$.

behavior when IS exploration exceeded IS exploitation. Therefore, hypothesis 2c was supported.

VI. Discussion & Conclusion

The organizational level of investigation on ambidexterity has long been asked to break down to the group or individual level. We included individual IS use context into the research on the importance of ambidexterity in an organization, where the concept of ambidexterity of exploration and exploitation from organization studies has been applied to individual employee's IS use pattern. Organizational IS is not able to be disaggregated from the tasks in an organization. In other words, there is few works that can be done without IS including computers, networks, software for communication, collaboration, reporting, data processing, or knowledge management. There is no exception from automatic operational works to managerial proactive decisions. In this line, the concept of ambidexterity is also critical in IS use inasmuch as in organizational process. Present study investigated the capability of technology and systems inside organizations as ambidexterity facilitator. IS plays a critical role in organizational redesign and transformation and hence it should not be excluded for the new design of organization which will increase ambidexterity.

The pattern of IS use is a critical subject for practitioners and scholars are getting interested in. For instance, the pattern of IS use, adaptive use of IS, strategic use of IS, are spotlighted. In other words, it is requested to be studied on how we should use IS for the success

of an organization since it gets more important than whether we will adopt information technology or not. There are different IS use patterns in different conditions with different effect. Current study helps to understand how the right choice of use pattern will impact an individual's working performance and eventually the organizational efficiency.

Among the pattern of IS use, exploratory or exploitative use of IS is started to get attention. The two types have been rarely studied in individual level of employee capability. Further, the different type of employees' IS use capability has been the focus of research very recently and yet there are few of them we can find. Finally, we found out how the IS use ambidexterity is directly related to the differential measures of performance as well as how the exploration and exploitation pattern of IS use are complementarily interacting each other to different type of works. With the result of this study, systems can be designed to provide options to choose a certain pattern of use or elicit the right pattern of use in different types of tasks.

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Ambidextrous Use of Information Systems in an Organization

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Abstract

Ambidexterity in organizations, in general, is interpreted as flexibility that enables organizational innovation, which is important for survival in a competitive market. It applies to individual workers as well since the ambidexterity of explorational and exploitational IS use will enable the flexible transition between dynamic and operational work, and hence, increase the work performance. The current study will therefore investigate the individual levels of exploratory and exploitative IS use, as well as the complementary relationship between exploratory and exploitative IS use. In a third step, the differential influence of IS on work performance will be evaluated. The current study validated that complementary fit of IS use exploration and IS use exploitation increases performance. Polynomial regression and surface analysis are used to validate the incongruence of IS use pattern. They showed that the incongruence of ambidexterity is composed of two types of divergent vs. convergent ambidexterity which depends on the type of work that need dynamic or operational capability.

Keywords: Ambidexterity, IS Exploration, IS Exploitation, Fit, Adaptation, Operation

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