Reexamining Relative Advantage and Perceived Usefulness:
An Empirical Study

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ABSTRACT

Relative advantage and perceived usefulness are often used interchangeably in the literature. In this paper, the authors argue that this limits the understanding of the adoption of ICTs, especially when there are multiple alternatives. To address this issue, the authors reexamine relative advantage in relation to perceived usefulness, providing a re-specification of relative advantage and empirically testing a model that explores the roles of these constructs in explaining and predicting the adoption of a new technology in the presence of an existing one. The results demonstrate that perceived usefulness and relative advantage are related but distinct constructs. In particular, relative advantage fully mediates the effect of perceived usefulness of existing technology on the intention to use a new technology, and partially mediates the effect of perceived usefulness of the new technology on the intention to use it. The findings have important theoretical implications that help investigators better apply these constructs in research, as well as practical implications for ICT promotion strategy.

Keywords: *Comparable ICT Applications, ICT Adoption, ICT Promotion Strategy, Perceived Usefulness, Relative Advantage*

INTRODUCTION

Information and Communication Technology (ICT) adoption is a topic extensively examined in the IS field. However, most ICT adoption studies seem to focus on the contexts where either only one ICT is available or alternative ICTs are unspecified or ignored (e.g., Agarwal & Karahanna, 2000; Agarwal & Prasad, 1998; Bhattacherjee & Premkumar, 2004). With the fast development of information technologies and fierce competition of IT suppliers in the market, it is not uncommon that organizations provide employees with multiple ICT options to support different aspects of work or fit unique work settings.

Indeed, employees often encounter highly comparable ICT applications that offer similar functionalities or services. For example, Internet browsers such as Internet Explorer and Firefox essentially implement the same set of network protocols and offer matchable user experiences. Google and Yahoo! are popular search engines that provide very similar services (see Appendix

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I for more examples). In face of multiple ICT options, users often primarily rely on one ICT application to do their jobs, because of the concern over redundant efforts (Choudhury & Karahanna, 2008). Thus, the decision to make is often more of "which one to use", or "whether an ICT is better", rather than "whether to adopt or not".

In this line of arguments, a key construct in the innovation diffusion literature is relative advantage (RA), which emphasizes the comparison of multiple innovations (Rogers, 2003). Nevertheless, RA has been largely treated as identical to another construct, *perceived usefulness* (PU), in IS studies. For example, Moore and Benbasat (1991) declared that "the similarities between these constructs [perceived usefulness and perceived ease of use] and Rogers' perceived relative advantage and perceived complexity are clear (p. 197)", implying that they are synonymous. In a similar manner, Adams et al. (1992) stated that relative advantage "can be considered analogous to usefulness (p. 231)". Plouffe et al. (2001) made the argument clearer by stating that "the set of constructs used in TAM is essentially a subset of those proposed by PCI (Perceived Characteristics of Innovation) (p. 211)".

Treating RA as identical to PU could be problematic when explaining and predicting the adoption of an ICT in the contexts where alternative ICTs are present, because one ICT could be perceived useful but still not adopted. Taking push mail on mobile devices as an example, although office workers may believe that it helps enhancing their productivity especially when moving around, it may not be perceived to have remarkable relative advantage over traditional e-mail. Therefore, it is of great importance to distinguish between RA and PU in ICT adoption research, especially in the contexts where there are multiple ICT alternatives.

As an attempt at this task, this study sets out to examine the relationship between RA and PU and explore their roles in ICT adoption both theoretically and empirically. Theoretically, we intend to provide an accurate account of existing conceptualizations and operationalizations of RA and PU in the literature. Empirically, we examine the effects of RA and PU on individuals' intentions to adopt an ICT in a representative context, the adoption of a pair of comparable ICTs. Particularly, we seek to answer the following two research questions:

RQ1: Will the existence of a comparable technology influence the adoption of a new technology?

RQ2: What is the relationship between Relative Advantage and Perceived Usefulness?

The answers to these two questions will help researchers select appropriate constructs to study ICT adoption in various contexts. Practically, they can offer insights into how to campaign for technology adoption when multiple ICTs are available to potential users.

This paper is organized as follows. First, we re-visit the conceptualizations and applications of PU and RA. We then introduce a model to test the relationship between PU and RA and their roles in explaining the adoption of a new ICT in the presence of an existing ICT and summarize the methodology and results. We also discuss theoretical and managerial implications and conclude the paper.

REEXAMINING RELATIVE ADVANTAGE

Several researchers have suggested that relative advantage and perceived usefulness are interchangeable in studying IT adoption. For instance, Karahanna et al. (2006) asserted that "perceived usefulness in TAM is equivalent to Rogers' relative advantage (p. 782)". A reasonable question that one may ask in turn is "is this always appropriate?" To address this question, we first go back to the original sources of relative advantage and perceived usefulness and compare their conceptualizations and operationalizations.

Original Conceptualizations and Operationalizations of PU and RA

Perceived usefulness (PU) was defined as "the degree to which a person believes that using a particular ICT would enhance his or her job performance" (Davis, 1989, p. 320) and has been widely adopted by followers (e.g., Adams et al., 1992; Taylor & Todd, 1995; Venkatesh & Davis, 2000; Venkatesh, Morris, Davis, & Davis, 2003). In this definition, Davis (1989) didn't specify any ICT alternatives explicitly as a comparison basis for users.

Relative advantage (RA) was introduced by Rogers in his book of *Diffusion of Innovations* (Rogers, 1962). Originally, RA was employed to capture the relative superiority of an innovation (in a very broad sense) and was defined as "the degree to which an innovation is perceived as being better than the idea it supersedes" (Rogers, 2003, p. 229).

Compared to the definition of PU, the definition of RA is different in two ways. First, the definition of RA explicitly mentions another innovation(s), i.e., the precursor of the current one under study. In this regard, the definition of PU is quite fuzzy; it does not clarify the existence or nonexistence of any alternative ICTs. Second, the definition of RA does not specify exactly in which aspects the ICT under consideration is superior to its precursor or competitor. Hence, although there clearly seems to be a relationship, RA and PU are conceptually different constructs.

In Davis' (1989) work, six items to measure perceived usefulness were recommended. Relative advantage was first operationalized as a survey instrument by Moore and Benbasat (1991) using five items. These two groups of items are quite comparable. In particular, RA1 is identical to PU1; RA3 is the same as PU5; RA5 is comparable to PU3; and RA4 is equivalent to PU4 (see Table 1). Moreover, *quality of the work* (as phrased in RA2) is semantically pertinent to *job performance* (PU2). Therefore, although the original conceptualizations of PU and RA are not identical, they are measured similarly, largely by the items proposed by Davis (1989).

Research that follows Moore and Benbasat's (1991) approach essentially equate RA with PU because the role of an ICT's precursor or competitor as mentioned in the original definition of RA is not captured explicitly by the measures. In the contexts where there are alternative ICTs, whether this treatment is ap-

Table 1. Original operationalizations of perceived usefulness and relative advantage

Constructs	Items
Perceived Usefulness (Davis, 1989; Davis, Bagozzi, & Warshaw, 1989)	PU1. Using the system in my job would enable me to accomplish tasks more quickly.
	PU2. Using the system would improve my job performance.
	PU3. Using the system in my job would increase my productivity.
	PU4. Using the system would enhance my effectiveness on the job.
	PU5. Using the system would make it easier to do my job.
	PU6. I would find the system useful in my job.
Relative Advantage (Moore & Benbasat, 1991)	RA1. Using the system enables me to accomplish tasks more quickly.
	RA2. Using the system improves the quality of the work I do.
	RA3. Using the system makes it easier to do my job.
	RA4. Using the system enhances my effectiveness on the job.
	RA5. Using the system increases my productivity.

propriate is open to question. When choosing from comparable ICTs, individuals usually examine them side-by-side, rather than evaluate each one against prior practices without ICTs respectively (Choudhury & Karahanna, 2008). Undoubtedly, the more useful one specific ICT is, the more likely it is adopted (Venkatesh et al., 2003). However, when multiple ICTs are available to potential adopters, the one regarded as better should have better opportunities to be used (Rogers, 2003). Hence, in such ICT adoption contexts, the concept of *relative advantage* is in a better position to reveal the decision mechanism of the subjects. Leaving out the comparison with other ICTs may thus disguise the actual mechanisms at work to form the intention to adopt an ICT, and in worst cases might lead to problematic conclusions.

Relative Advantage: Working Definition

To distinguish between PU and RA in the contexts where multiple ICTs coexist, we offer a working definition of RA in this study. We define relative advantage as "*the degree to which using a particular ICT is perceived as being better in terms of enhancing job performance than using its preceding/competing technologies*". This definition stresses explicit comparison and emphasizes the performance improvement aspect of ICTs within organizational contexts.

In this study, we examine only the performance improvement aspect of RA because, although Rogers' (1962) initial conceptualization of RA is fairly rich, most of the elements have been extracted and captured by other constructs. For instance, *economic profitability* of innovations emphasized by Rogers is captured by the construct of *payoff* (Fliegel & Kivlin, 1966); *initial cost* is reflected by *perceived cost* (Jones, Mothersbaugh, & Beatty, 2002; Yang & Peterson, 2004); *decrease in discomfort* is similar to *saving of discomfort* (Fliegel & Kivlin, 1966); and *social prestige* can be gauged through *image* (Moore & Benbasat, 1991) or *social approval* (Fliegel & Kivlin, 1966). In addition, in the ICT adoption literature, the emphasis of RA is on performance improvement. Hence, we choose to focus solely on this aspect of relative advantage accordingly in this study.

Alternatively, RA has been conceptualized as a multidimensional construct in the literature. For example, in the context of electronic channels adoption, Choudhury and Karahanna conceptualized relative advantage as a formative construct consisting of three sub-dimensions: *convenience*, *trust*, and *efficacy of information acquisition* (2008). However, a multidimensional view of RA would not serve the research objective of distinguishing it from PU. Hence, we define relative advantage in a general sense in this study without specifying detailed advantage dimensions regarding performance. With regard to operationalization, we adapt existing items to measure RA in light of our working definition. In each question, an alternative/rival technology is explicitly specified to serve as a basis of comparison.

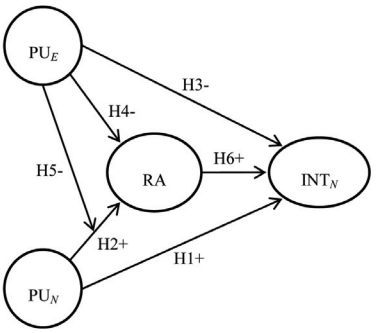
EMPIRICAL STUDY

Having discussed the issues with existing use of RA in the literature and proposed a respecification, we put it through an empirical test to explore further its relationship with PU and test its effect on ICT adoption in the presence of multiple comparable ICTs. In this test, we focus on the context where there are only two competing technologies: an existing technology (IT_E) and a new technology (IT_N). In particular, we choose to study traditional e-mail (IT_E) and electronic mail on mobile devices, named m-mail (IT_N), as a pair of comparable ICTs as they essentially provide very similar functions. Figure 1 summarizes the theoretical model.

Perceived Usefulness of the New Technology (PU_N)

Within organizational contexts, people are usually rewarded for good performance (Davis, 1989). Thus, for ICTs perceived as useful in

Figure 1. Research model



PU: Perceived Usefulness; INT: Intention to Use; RA: Relative Advantage; Subscript E: Existing Technology; Subscript N: New Technology.

terms of enhancing job performance, individuals will have the motivations and intentions to utilize them. Therefore, we expect the perceived usefulness of a new technology (PU_N) to have a positive impact on the intention to use this technology (INT_N).

H1: Perceived usefulness of IT_N is positively related to the intention to use IT_N.

In the contexts of multiple ICTs, the perception of the superiority of one particular ICT should be based on the comparison of all the ICT options available (Ridings & Gefen, 2000; Rogers, 2003). The usefulness of other ICTs being constant, the more useful one ICT option appears (in an absolute sense) in terms of improving work performance, the higher level of advantages will be perceived in relative to its competitors. Thus, we propose:

H2: Perceived usefulness of IT_N is positively related to the RA of IT_N.

Perceived Usefulness of the Existing Technology (PU_E)

Although users have two ICT applications at disposal, the total amount of time allocated for their jobs are not unlimited. Hence, it is often preferable to choose one rather than both to accomplish their jobs. Although sometimes it is feasible to use two ICT applications simultaneously, switching back and forth between them often takes additional efforts. For example, adding a new friend's e-mail address into the contact list of certain e-mail management software would take a few seconds. To make this friend's address accessible from a Blackberry device, users have to synchronize the device with the e-mail management software, which involves more efforts than using solely e-mail or mobile mail. Therefore, the resulting switching cost fosters a competing relationship between the ICT applications: the more useful one thinks an existing technology is, the less likely one inclines to use the new technology.

H3: Perceived usefulness of IT_E is negatively related to the intention to use IT_N.

Since the two technologies under scrutiny are comparable, the superiority or advantage of one technology will make its rival less appealing because they compete for users' attention (Rogers, 2003). Thus, assuming that the *Perceived Usefulness* of the new technology is fixed, the more useful the existing technology (IT_E) in terms of performance improvement is, the less the added value of IT_N should be perceived. Therefore, we expect:

H4: Perceived usefulness of IT_E is negatively related to the RA of IT_N.

Whereas the direct relationships among PU_E, PU_N, and *RA* are straightforward, the effects of PU_E and PU_N on *RA* may go beyond simple linear combination as the interaction of the two may also contribute to RA. When a new technology has a very compelling rival (IT_E), the relative advantage of the new technology will be much lower than expected. The reason is that users could easily be reminded of the existence of a strong competitor. On the other hand, if its rival (IT_E) does not look very compelling, the relative advantage of the new technology (although also undermined by the existence of rival ICTs) may not be eroded that much. In extreme cases, the users might even "forget" the existence of an established competitor. Therefore, besides a direct relationship from PU_E to *RA*, PU_E may also affect the influence of PU_N on *RA* such that such influence is higher when PU_E is lower. Thus, we hypothesize:

H5: Perceived Usefulness of IT_E will moderate the effect of Perceived Usefulness of IT_N on *RA* of IT_N such that the effect is stronger when Perceived Usefulness of IT_E is lower.

Relative Advantage of the New Technology (RA)

Relative advantage has been underscored to be the key factor accounting for the adoption of an innovation (Rogers, 2003). As discussed in previous sections, in the context of ICT adoption, the more beneficial an ICT appears in relative to its competitors, the more users are motivated to adopt it. Therefore, a positive relationship between RA of IT_N and the intention to use IT_N (INT_N) is expected.

H6: Relative advantage of IT_N is positively related to the intention to use IT_N.

METHODOLOGY

Instrument Development

This study involves many well-established constructs in the ICT adoption literature. For such constructs, we adapted existing measures to fit the current research context and transformed them to 7-point Likert scales when applicable. Because most of the adapted measures have demonstrated good quality in prior research, no pilot test was conducted. Appendix II lists key constructs and corresponding items.

Special attention was paid to the items of *perceived usefulness*. We emphasized the absolute sense of usefulness by adding "o*n its own*" in each question (see Appendix II). The expectation was that, by wording them this way, respondents would provide their beliefs about the degree of usefulness of one IT product without comparing it with other technologies.

Data Collection

We recruited undergraduate students taking a business course at a public university in Canada as respondents. As per the policy of this course, students had the chance to earn 0.5 credits for participating in research. The participation was voluntary and the students could quit whenever they wanted without any punishment.

The questionnaire was administrated on the internet. 350 responses were obtained in a period of 6 weeks with 1 response not usable. The average age of the respondents was 18.4 years and 51.6% were male. Participants had an average of 10 years of computer experience and 7.6 years of e-mail experience. Although the subjects have adequate knowledge about m-mails, only 31.5% of them had ever used or are currently using m-mail services.

Data Analysis

We used Partial Least Squares (PLS) to test the research model as PLS permits the estimation of

the measurement model within the theoretical context (Barclay, Higgins, & Thompson, 1995; Chin, 1998). SmartPLS (Version 2.0.M3) was employed (Ringle, Wende, & Will, 2008) as the analytical tool and bootstrap resampling approach (500 subsamples) was used to determine the significance of the hypothesized relationships.

Besides the variables depicted in Figure 1, a set of variables have been identified by prior research to be predicators of *intention*. Therefore, we controlled for the effects of the following variables in the analysis: *Perceived Ease of Use* (Davis, 1989; Venkatesh & Davis, 2000), *Others' Use* (Compeau, Higgins, & Huff, 1999; Compeau & Higgins, 1995; Compeau, Meister, & Higgins, 2007), *Compatibility with Existing Work Practices* (Karahanna et al., 2006), and *Purchasing Cost* (Yang & Peterson, 2004).

RESULTS

Table 2 summaries the descriptive statistics of key constructs. In general, e-mail was perceived by respondents as highly useful (with a mean of 6.05 out of 7) while m-mail was perceived as somewhat useful (with an average of 4.71). This result suggests that *although m-mail was beneficial to performance improvement in itself, it was not very appealing*. A similar conclusion can be obtained from the average of relative advantage of m-mail (3.92), which is a little lower than the neutral value of 4, suggesting that respondents might slightly favor e-mail.

Measurement Model

To test the measurement model, we checked individual item reliability, internal consistency, convergent validity, and discriminant validity (Barclay et al., 1995; Gefen, Straub, & Boudreau, 2000).

To achieve acceptable individual item reliability, the loading of each item with its corresponding construct needs to be greater than 0.7, implying that 50% or more variance in this item is explained by the construct (Barclay et al., 1995). An initial test revealed that all indicators of main theoretical constructs demonstrate adequate reliability (see Table 3).

Table 4 describes the intercorrelations and internal consistency reliabilities of the constructs. All reliability indicators are 0.8 or higher, well above the recommended level of 0.7 (Fornell & Larcker, 1981), suggesting adequate internal consistency.

Convergent validity is acceptable if a construct has an average variance extracted (AVE) of 0.5 or above (Fornell & Larcker, 1981). As shown in Table 4, the AVE of each reflective construct is higher than the cutoff value, indicating adequate convergent validity.

To show satisfactory discriminant validity, the square root of the AVE of each construct should be greater than the correlations between this construct and other constructs in the model (Chin, 1998). Illustrated in Table 4, all the constructs satisfy this criterion. In particular, the square root of the AVE of RA is 0.88, which is noticeably larger than its correlations with perceived usefulness of m-mail (0.72) and that of e-mail (0.13). In addition, the loadings of

Table 2. Descriptive statistics of key constructs

Measure	Item Number	Mean	Standard Deviation
Perceived Usefulness (e-mail)	5	6.05	.96
Perceived Usefulness (m-mail)	5	4.71	1.24
Relative Advantage (m-mail)	5	3.92	1.44
Intention to Use (m-mail)	4	4.63	1.61

All scales are 7- point Likert scales.

Table 3. PLS outer model loadings

Items	PLS Outer Model Loading	Items	PLS Outer Model Loading
EPU1	.73	MPU1	.84
EPU2	.77	MPU2	.89
EPU3	.85	MPU3	.90
EPU4	.81	MPU4	.90
EPU5	.81	MPU5	.75
RA1	.89	MINT1	.93
RA2	.89	MINT2	.93
RA3	.89	MINT3	.93
RA4	.83	MINT4	.79
RA5	.92		

MINT =Intention to use m-mail; EPU =Perceived Usefulness (e-mail); MPU =Perceived Usefulness (m-mail); RA=Relative Advantage of m-mail

Table 4. Reliability, correlations and discriminant validity

	ICR	Alpha	EPU	MPU	MINT	RA
EPU	0.88	0.86	**0.78**			
MPU	0.93	0.9	0.36	**0.85**		
MINT	0.94	0.92	0.19	0.69	**0.89**	
RA	0.95	0.93	0.13	0.72	0.61	**0.88**

ICR=Internal Consistency Reliability; The diagonal elements are the square root of the average variance extracted (AVE, indicating the average correlation between the construct and its measures). The off diagonal elements show the correlations between constructs.

RA's items on their construct are considerably larger than their cross loadings on perceived usefulness of m-mail or e-mail with a minimal margin of 0.2 (see Table 5). Hence, the empirical evidence supports that RA and PU are indeed distinct constructs (e.g., Wixom & Todd, 2005).

Structural Model

The test of structural model involves the estimation of path coefficients and significance levels of these coefficients. As shown in Figure 2, four out of the six hypothesized relationships are significant and in the predicted directions. Overall, the model explains 67% of the variance in INT_N and 50% of the variance in RA.

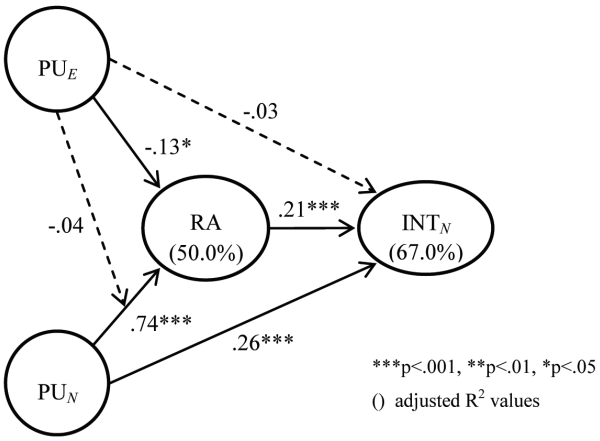
As expected, perceived usefulness of IT_N significantly influences intention to use IT_N (H1) and relative advantage of IT_N (H2) and the effects are in the predicted directions. Perceived usefulness of IT_E has a significant negative effect on relative advantage of IT_N (H4), which in turn has a significant positive effect on intention to use IT_N (H6).

However, the negative relationship between perceived usefulness of existing technology (PU_E) and the intention to use the new technology (INT_N) was not significant. In light of the findings above, this indicates that perceived usefulness of the existing technology affects the intention to use the new technology through its effect on RA. This pattern is different from the

Table 5. Results of factor analysis

	EPU	MPU	MINT	RA
epu1	**.73**	.18	.12	.04
epu2	**.77**	.1	.09	0
epu3	**.85**	.26	.09	.09
epu4	**.81**	.39	.23	.15
epu5	**.81**	.33	.16	.11
mpu1	.29	**.84**	.6	.61
mpu2	.21	**.89**	.58	.64
mpu3	.28	**.9**	.6	.67
mpu4	.24	**.9**	.61	.66
mpu5	.26	**.75**	.59	.52
mint1	.13	.66	**.93**	.6
mint2	.19	.62	**.93**	.53
mint3	.18	.66	**.93**	.6
mint4	.09	.54	**.79**	.47
ra1	.05	.61	.47	**.89**
ra2	.13	.69	.63	**.89**
ra3	.14	.69	.57	**.89**
ra4	-.01	.58	.54	**.83**
ra5	.09	.63	.5	**.92**

Figure 2. PLS results



relationships among PU_N, RA, and INT_N, where PU_N has both direct and indirect effects on INT_N.

The interaction effect between PU_E and PU_N was not observed either. The result suggests that only main effects of PU_E and PU_N account for the variation within RA. PU_E and PU_N seem to have linear relationships with RA.

Testing Mediation Effects of RA

Empirical results of the structural model suggest that RA might partially mediate the effect of PU_N on INT_N, and fully mediate the effect of PU_E on INT_N. Nevertheless, more rigorous tests should be conducted to further validate the mediation effects.

One statistical test often used to test mediation effects is the Sobel test (Baron & Kenny, 1986). Basically, Sobel test is based on analysis of two groups of regression coefficients. The resulting p-value of Sobel test indicates whether the indirect effect of the independent variable on the dependent variable via a mediator (in our case, RA) equals zero.

We followed the standard procedure of Sobel test and the results are shown in Table 6. Please note that the testing method used in this paper is statistically equivalent to the traditional three stage Sobel test. As a result, the mediation effects of RA were confirmed, no matter whether perceived usefulness of alternative technology was controlled or not.

DISCUSSION

We set out to examine the relationship between PU and RA and their roles in the adoption of ICTs when multiple alternatives coexist. Empirical evidence supports that PU and RA are related but distinct constructs – RA is a linear function of the PU of new and existing technologies and is a significant antecedent of the intention to use the new technology.

Theoretical and Practical Implications

The findings underscore the importance of including RA as originally intended in studying ICT adoption, especially when there are competing technologies. While the PU of a technology does explain the adoption of it to some extent, its RA allows us to incorporate the influence of other technologies that would be otherwise ignored. In a post hoc test to examine the mediating effects of RA, we found that RA partially mediated the effect of perceived usefulness of m-mail on intention to use m-mail but not the effect of perceived usefulness of e-mail – there was no significant direct relationship between these two constructs. In other words, perceived usefulness of e-mail could only affect intention to use m-mail via the path through RA. This result suggests that the influence of a competing ICT may not be captured without explicitly including RA. Therefore, RA that stresses explicit comparison is able to help achieve a more comprehensive understanding of ICT adoption.

The results also provide insights into the choice of proper constructs for researchers. In contexts where the focal ICT is the only or first available one to potential adopters, it seems appropriate to use PU as a proxy of RA as the

Table 6. Testing mediation effects of relative advantage

Independent Variable (IV) and Dependent Variable (DV)	Control Variable	t_a*	t_b*	p-value
PU_E and *INT*	PU_N	3.935	3.650	.0075
PU_N and *INT*	PU_E	20.532	3.650	.0003
PU_E and *INT*	--	2.368	13.515	.0196
PU_N and *INT*	--	20.136	3.429	.0007

*t_a: t-test statistics for the differences between *a* and zero, where *a* is the unstandardized regression coefficient for the association between IV and mediator; t_b: t-test statistics for the differences between *b* and zero, where *b* is the unstandardized coefficient for the association between the mediator and the DV (when the IV is also a predictor of the DV)

basis of comparison for both is manual work or the situation without any technology. However, when alternative ICTs coexist, potential adopters are prone to judge the superiority of the technology in question based on the evaluations of others. In this case, relative advantage cannot be deemed as the same as perceived usefulness; rather, it should be specified explicitly in the theoretical model.

Practically, this study encourages more attention being paid to comparable technologies when they exist as viable options. While comparable technologies often share certain features with the latest alternative, the new technology usually has certain features that are absent in the existing ICT or it fits certain contexts better. When new features are present in the new technology, relative advantages should be singled out and highlighted in any promotion efforts. Implementing this strategy will maximally leverage the investments in intervening programs. If the new technology fits work contexts better, it is advisable for managers to analyze the needs of potential users and stress the fit between them and the new technology. This directs managerial attention to the requirements of different jobs, the sorts of unique supports offered by the new ICT, and the match between jobs and ICTs (Goodhue & Thompson, 1995). In either case, managerial efforts should be balanced among all relevant technologies rather than focused on the new one only. A richer understanding of other technology options and users' work contexts will enable managers to do a better job in ICT promotion campaigns.

Limitations

Two limitations should be noted when interpreting the results. First, the exclusive use of the survey method may introduce common-method bias. Careful research design and the results of reliability and validity tests make us believe that it is unlikely to be an issue (Wixom & Todd, 2005). However, future research employing other data collection methods is able to provide meaningful triangulation and more confidence in the findings. Second, university students may be different from the general workforce because they tend to have low incomes and more flexible schedules, undermining the generalizability of the findings. Therefore, we encourage researchers to test the proposed theoretical model using other ICTs and/or in different organizational contexts.

CONCLUSION

With the advancement of contemporary information technology, potential adopters face more complex situations where they may have to choose among competing technologies. However, a key factor to understand such a phenomenon, namely relative advantage, may have been confounded with perceived usefulness. To make a clear distinction between RA and PU, we have examined their relationship and explored their roles in ICT adoption both theoretically and empirically. Though they could be viewed as interchangeable when the ICT in question has no rivals available, these two constructs are found to be different in the contexts where multiple ICTs compete for the attention of users. RA is more appropriate in the latter case as it allows a more accurate and comprehensive account for the adoption of an ICT by considering the influence of its competitors.

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APPENDIX I.

Table A1. Examples of comparable ICT couples

ICTs	Examples
Mail services	Gmail and Blackberry
Internet browsers	IE and Firefox
Text editors	UltraEdit and EditPlus
Statistical software	SPSS and SAS
Search engines	Google and Yahoo!
Social network sites	Facebook and Myspace

APPENDIX II.

Table A2. Measures of key constructs

Perceived Usefulness (e-mail/m-mail) (Davis, 1989;Davis et al., 1989)
PU1: On its own, e-mail/m-mail enables me to accomplish tasks more quickly.
PU2: On its own, I found e-mail/m-mail useful in my job.
PU3: On its own, using e-mail/m-mail enhances my effectiveness.
PU4: On its own, using e-mail/m-mail increases my productivity.
PU5: On its own, using e-mail/m-mail improves my performance.
Intention to Use (m-mail) (Taylor & Todd, 1995;Venkatesh & Davis, 2000)
MINT1: I intend to use m-mail in the future.
MINT2: I expect that I would use m-mail in the future.
MINT3: I predict that I would use m-mail in the future.
MINT4: I plan to use m-mail in the next several months.
Relative Advantage of m-mail (Lim & Benbasat, 2000)
RA1: M-mail enhances my job effectiveness to a greater extent than e-mail does.
RA2: Using m-mail improves my performance more than only using e-mail.
RA3: Using m-mail enables me to accomplish tasks more quickly than using e-mail.
RA4: M-mail is more useful than e-mail.
RA5: M-mail increases my productivity more than e-mail does.

Note: Lim and Benbasat originally named their construct as Perceived Usefulness (2000). In our current operationalization, it refers to Relative Advantage.