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Continuing Use of Information Technology as Value Co-creation: The Role of Contextual Variety and Means Drivenness

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- Dematerialisation
- Service Design
- Value and Business Models
- Visualisation
- Viable Service Systems and Transformation

Continuing Use of Information Technology as Value Co-creation: The Role of Contextual Variety and Means Drivenness

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Introduction

Understanding antecedents of Information Technology (IT) use has been a core stream within Information Systems (IS) research, and it has had a steady following since the original proposal by Davis' Technology Acceptance Model (TAM) (Davis 1989). In most studies, the antecedents of IT use tend to focus on rational evaluations (e.g. Karahanna, Straub and Chervany 1999; Venkatesh and Davis 2000), but some researchers (e.g. Kim, Chan and Chan 2007a; Davis, Bagozzi and Warshaw 1992; Beaudry and Pinsonneault 2010) also acknowledge the existence of affective inputs to the formation of the individual's adoption intentions and use behaviors.

Yet, technology use is often set within a context. The use of the Internet, smartphones or computers is usually triggered by environmental cues (Ortiz de Guinea and Markus 2009). In some situations, IT could be an enabler, which fulfills the user's instantaneous contextual needs, such as the user reimbursing a friend using Paypal on the mobile phone just after a shared meal. With increasing digitization and connectivity such as the rise of social media, it becomes harder to discern if IT is the enabler or indeed, is the stimulus itself, as IT is now ubiquitous and could have possibly become an environmental trigger. Consequently, there have been calls for more research to be done to meet the challenge of understanding IT use behavior (Ortiz de Guinea and Markus 2009).

Our paper proposes a Service Dominant Logic (S-D Logic) view of technology use as value co-creation in context. We argue that continuing IT use could be reconceptualized as *value-in-use* that results from co-creation within an ongoing set of contexts or systemic states of which the individual is a part. Such a perspective brings in not only cognitive and affective user motivations but contextual cues as well. Furthermore, we posit that where contexts are varied to the extent that goals are unpredictable, individuals could be means-driven rather than goal-driven. Means Drivenness, taken from effectuation logic, differs from causal logic that where the latter considers the different ways to achieve given goals, the former considers that individuals create different goals with existing means (Sarasvathy 2008). We argue that TAM employs a causal logic towards technology use, while effectuation logic could be an alternative way to understand how individuals' technology use is a coping mechanism for complex environments.

We propose two context-focused variables – that of Contextual Variety and Means Drivenness that impact upon the frequency of continuing IT use. The former is defined as the degree of variability in the set of contexts within which the individual faces in co-creating value through continuing IT use, and the latter is defined as an individual's tendency to acquire new means, a coping mechanism to deal with an uncertain future.

Through both qualitative and quantitative studies of Smartphone users, we found that Contextual Variety and Means Drivenness impact on use behaviors, and they mediate the relationship between perceived usefulness and frequency of continuing use. We also show that increased Contextual Variety drives Means Drivenness. This suggests that the usefulness of technology does not drive frequency of use unless

the individual faces higher Contextual Variability in his or her life. It is also suggests that the individual has to be means-driven for use frequency to increase.

This paper proceeds as follows. The next section reviews literature on continuing IT use. The two variables of Contextual Variety and Means Drivenness are presented through a theoretical argument and the research hypotheses proposed. The subsequent section presents the research method, followed by the results. The paper concludes with a discussion of the results, contributions to research and practice, and directions for future research.

Theory And Hypotheses Development

Continuing IT Use

Following the tradition of Ajzen and Fishbein's (1975, 1980) work, the Technology Acceptance Model (TAM) (Davis 1989, Venkatesh and Davis 2000) is an adaptation of the Theory of Reasoned Action (TRA) into the field of Information Systems (IS). TAM replaces many of the TRA's attitude measures with the two technology acceptance measures of perceived ease of use and perceived usefulness. The model posits that when individual users are presented with a new technology, perceived ease of use and perceived usefulness will influence their intention to use it, with the intention to use serving as a mediator of actual usage. TAM has been continuously studied and expanded on, with attempts of extensions having generally taken one of three approaches: by introducing factors from related models, by introducing additional or alternative belief factors, and by examining antecedents and moderators of perceived usefulness and perceived ease of use (Wixom and Todd 2005).

However, researchers generally agree that adoption and continuing use are two different processes, and the latter cannot be simply regarded as an extension of the former. Empirical studies showed only perceived usefulness is relevant in *continuing* IT use (Bhattacherjee 2001). Based on the expectation-confirmation theory, Bhattacherjee (2001) argued that in addition to perceived usefulness, other influencing factors such as satisfaction can emerge in the course of IT use. Beliefs and attitude toward IT use are continuously updated based on users' experience (Bhattacherjee and Premkumar 2004, Kim and Malhotra 2005). A common assumption among these models is that continuing IT use is a cognitive choice. Recently, some researchers attempted to incorporate affective factors such as pleasure, arousal, and perceive enjoyment into the investigation of continuing IT use (Kim, Chan and Chan 2007a, Thong, Hong and Tam 2006). Others suggested that habit is also a critical determinant factor, which could moderate the relationship between intentions and use behavior (Limayem, Hirt and Cheung 2007). All these models have greatly advanced our understanding of continuing IT use. Nonetheless, none of them paid any attention to contingency factors that could affect the context of use (Ortiz de Guinea and Markus 2009).

In a recent article, Ortiz de Guinea and Markus (2009) argued that 'environmental cues may be the most important means of improving people's continuing IT use'

(p.440) and 'information technology itself- at the device or the feature level- may also serve as an extraordinary powerful environmental mental cue' (p.441). Continuing IT use means that the context of use could be dynamically changing, either because of physical changes (such as using a phone in different places) or changes to the individual's state that influences the way s/he would interact. This is echoed by some research on mobile services. Ghose and Han (2011) suggested that travel patterns have an impact on an individual's mobile use, and Mallat et al. (2009) proposed that use context affects user attitude and therefore influences acceptance of mobile services. Overall, examination of IT use and contexts is still in its infancy. It is necessary for researchers to direct the attention to *the contexts* of IT use as potential drivers of continuing IT use.

Value-in-use and Contextual Variety

Recent influential papers by Vargo and Lusch (2004, 2008) have suggested the S-D Logic view, which acknowledges that the individual is always a co-creator of value, and the firm cannot deliver value, but only offer value propositions. Therefore, we argue that continuing IT use at an individual level could be reconceptualized as value co-creation within ongoing contextual states of service systems in which the individual sits, and where cognitive, affective and environmental factors all have a role within the system.

Given that value is created in ongoing use situations, situational or environmental conditions of context could affect the co-creation (for literature on situational and contextual value, see Beverland, Farelly and Woodhatch 2004; Flint, Woodruff and Gardial 2002; Lemon et al. 2002; Lapierre, Tran-Khanh and Shelling 2008). Palmetier (2008) stated that contextual variables may arise from changes in the physical environment, originating either from the provider and/or from the customers themselves. In using technology, there could be a number of contingent factors affecting value creation, and such factors will create variety in the way technology is used each time, even by the same individual consuming the same service or product.

Very few studies in IT use, with the exception of Mallat et al. (2009), have directly investigated the role of context. For example, emotion-based studies have focused on emotions triggered by the users' expectations and experiences of how IT use affects their work and performance. Cognitive-based models, such as studies within the TAM's tradition have continually focused on the user's rational analysis of technology traits but largely ignored context of use.

Contextual Variety and Resource Integration

S-D Logic proposes that value co-creation is achieved through the integration of resources. Vargo and Lusch (2004) distinguish operant resources from operand resources that are involved in creating value. Operand resources, such as raw materials, are "… resources on which an operation or act is performed to produce an effect" (Vargo and Lusch 2004, p. 2). This type of resource is usually tangible (although not always), inert and passive, requiring input from an active agent in

order to realize its value potential (Arnould, Price and Malshe 2006; Lusch, Vargo and Wessels 2008). In contrast, operant resources are those that are employed to act on operand resources and on other operant resources in order to create value. These are usually intangible resources such as knowledge, skills and labor (Vargo and Lusch 2004; Arnould, Price and Malshe 2006). Neither type of resource has inherent value, but offers value potential that may be realized through its integration with other resources.

Within the perspective of continuing IT use, a new technology such as a smartphone application (app) is an operand value proposition, and the realization of that proposition is through interaction with the individual's operant resources such as knowledge, ability and skill. Hence, in the use of IT, individuals act as the resources integrators to achieve benefits for themselves. Since resource 'become' resources only in context, both the material technology and the individual, as entities within a context, renders a 'service' based on the individual's ability to access and leverage resources from himself/herself and from the technology available in context. IT use could then be seen as a potential 'enabling' or a 'reliving' resource (cf. Normann, 2001), depending on what outcomes the individual wishes to achieve (Christensen et al., 2007). A phone could *enable* the resource of a phone call to be made (it could not make the phone call for the individual) but it could also *relieve* the individual from remembering the number to call, if it has the person's number stored in its memory storage.

Indeed, the context sets out the conditions "under which different resources will or will not be valuable" (Barney et. al., 2001:43). We therefore adapt Chandler and Vargo's (2011) definition of context as *a set of unique actors or entities with unique reciprocal links among them*, and that "context heterogeneity affects how resources can be drawn upon for service" (Chandler and Vargo, 2011:p. 6). We consider such context heterogeneity as *contextual variety* and define it as *the degree of heterogeneity or variability in the set of contexts within which the individual faces in co-creating value through continual use of a product or technology*. For example, an individual listening to music on his iPod not only on train journeys, but in the gym during exercise, and/or while having lunch would exhibit a higher Contextual Variety in creating value with his or her iPod than another individual who only listens to music before bedtime.

Contextual Variety therefore highlights the heterogeneity of resources that could be leveraged or accessed to achieve the same outcome continually for an individual over time in IT use. Such a heterogeneity of resources can come about due to environmental conditions or the individual's personal conditions. In other words, context is not defined by the entities, but by the linkages and interactions between them. These linkages and interactions would be dynamically changing when the use of IT is of high contextual variety, as a consequence of individuals appropriating different resources in such contexts to achieve the outcomes they require.

Contextual Variety in the use of technological offerings is increasingly pervading modern society, as individuals seek more resources to integrate to achieve multiple roles and tasks within their daily lives. Technological innovation in the forms of

iPhones, iPads, and other handheld devices have resulted in greater integration and interconnectivity, creating new resources in contexts and allowing individuals to be more productive and achieve outcomes in more varied conditions. Today, one could read a local newspaper globally, share presentations and have group meetings in virtual spaces and allow a stay-at-home mother to do the accounts of a corporation halfway across the world. While laudable, we argue that the use contexts of technology have increased in variety, resulting in hyper-variety of use. From our perspective, value is continually co-created with technology in increasingly dynamic and variable contexts and with increasing uncertainty of resource types.

We propose that Contextual Variety would have an impact on frequency of continuing technology use. This is because as individuals' lives become more complex, their need to integrate resources more effectively in dynamically changing contexts will increase, and technology allows them to do this more effectively. Therefore we propose the following hypothesis:

H1: Contextual Variety positively affects frequency of continuing IT use.

Effectuation Logic and Technology Use

We argue that Contextual Variety also has a secondary impact from the perspective of emergence of goals. If context is dynamic and heterogeneous and technology assists the individual to achieve different outcomes in context, the goals of individuals in such hyper-variety contexts may not be known in advance. As an example, the individual may not know in advance that he would be using the app on his iPhone to take a photo of a sofa and email it to his wife at that moment for her opinion. Both the technology (app) and the individual's own resources to be integrated for value co-creation are familiar although the context may be different or new. With greater digitization and interconnectivity of technologies encroaching into various aspects of individual lives, it is clear that individuals could be empowered to achieve outcomes in more varied contexts and have different outcomes as well.

Studies in technology use often do not satisfactorily explain technology use where goals are emergent. TAM's proposal that perceived ease of use and perceived usefulness are drivers of technology use implicitly assumes that the individual knows the goal and the context in which outcomes are achieved. This is echoed in many studies in existing literature where the acceptance of technology is goal-driven (Wu and Wang 2005; Turel, Serenko and Bontis 2007; Kim, Mirusmonov and Lee 2010; Kim, Chan and Gupta 2007b; and Kim and Oh 2010). These models assume that when a customer forms an intention to accept or use a new application, this action is assumed to be purpose-driven and the technology itself is perceived to be inherently useful or valuable for some outcome. Most studies within IT use are conducted in an organizational context in which the major purpose for using IT is to enhance work performance such as effectiveness, efficiency and utility (Nysveen et al., 2005), often through a computer where Contextual Variety in use may not be high since a desktop computer is used much the same way every day. However, context of using IT (e.g. Smartphones) could exhibit hyper-variety, potential goals are emergent and

by its nature of not being pre-determined, it cannot provide any indication of ease of use or usefulness. In the earlier example about the iPhone app, neither the app (camera) nor its use is new; yet the goal emerged in a new context and the individual has to form the awareness of being able to create value from a resource that is available in context, and that he has the means to achieve an outcome of consulting his wife at that moment. This suggests that the continuing use of IT may not be a consequence of a causal logic (where goals are pre-determined) but that of an effectuation logic as we will discuss below.

Sarasvathy (2001) explains the two logics below:

> "*Causal rationality begins with a pre-determined goal and a given set of means, and seeks to identify the optimal - fastest, cheapest, most efficient, etc. - alternative to achieve the given goal...Effectual reasoning, however, does not begin with a specific goal. Instead, it begins with a given set of means and allows goals to emerge contingently over time from the varied imagination and diverse aspirations.*" (Sarasvathy 2001, p. 6)

Causal logic provides a useful decision criterion to achieve given goals subject to environmental selection in the face of an uncertain future, whilst effectuation provides useful design principles for transforming extant environments into new futures in the face of ambiguous goals (Sarasvathy 2008). Thus, we argue that TAM subscribes to a causal logic. It proposes that perceived usefulness and ease of use towards a predetermined goal drives adoption. Effectuation, conversely, is the inverse of causation. It begins with given means and seeks to create new ends using non-predictive strategies (Sarasvathy 2008). We therefore argue that continuing IT use (as opposed to adoption), subscribes to effectuation logic. Such logic is based on non-predicted control by reducing the use of predictive strategies to control uncertain situations, as Sarasvathy stated that 'to the extent we can control the future, we do not need to predict it' (Sarasvathy 2008, p. 23). Effectual logic thus highlights the principle of means-driven (as opposed to goal-driven) actions. This emphasizes that individuals specially create something new with existing means rather than discovering new ways to achieve given goals (Sarasvathy 2008).

Sarasvathy's work suggests that a decision involving effectuation consists of a given set of means (including relatively unalterable characteristics of the decision maker), a set of effects (mostly generated through the decision process), constraints on (and opportunities for) possible effects and criteria for selecting between effects (usually a predetermined level of affordable loss). However, we posit that since outcomes and resources are contextual, the *means* to access and appropriate resources in context is therefore a context-focused variable and we define Means Drivenness, as the individual's tendency to acquire new means (potential resources in context), is an important variable for continuing IT use. For example, individual customers may try a particular app to find out what resources it could provide for emergent goals to achieve different ends. Such Means Drivenness may be more prevalent when the individual's use contexts exhibit high Contextual Variety e.g. for highly active urban dwellers. We therefore propose the following hypothesis:

H2: Means Drivenness positively affects frequency of continuing IT use.
H3. Contextual Variety positively affects Means Drivenness.

While we propose Contextual Variety and Means Drivenness as two context-focused variables, we are interested in understanding how such constructs play a role within TAM. Several TAM studies have already established the positive relationship between perceived usefulness and adoption of technology (e.g. Davis, 1989, Venkatesh and Davis, 2000) as well as use of technology (e.g. Bhattacherjee, 2001). We propose that our context-focused constructs of Means Drivenness and Contextual Variety could be intervening variables in that relationship. This is because even if a particular technology is useful, the frequency of continuing use would depend on how much Contextual Variety the individual encounters in his or her use of the technology. Without Contextual Variety, IT could be useful, but not used frequently. This may be because new contexts may spur an individual to use IT to cope with changing states, resulting in more frequent use. Therefore, we propose that the impact of perceived usefulness on the frequency of continuing technology use is influenced by the degree of Means Drivenness and Contextual Variety.

The following hypotheses follow:

H4. Means Drivenness mediates the positive relationship between perceived usefulness and frequency of continuing technology use.
H5. Contextual Variety mediates the positive relationship between perceived usefulness and frequency of continuing technology use.

In summary, we emphasize the importance of context in technology use which creates variety in use and emergent goals for resource integration, and propose that such hyper-variety emergent goals could result in individuals adopting an effectual logic to co-create hyper-variety value-in-use. Our study, in setting up the above hypotheses, investigates the impact on the frequency of continuing use of information technology by two new context-focused variables – that of Contextual Variety and Means Drivenness.

Research Method
Our study uses smartphones as an exemplar for IT due to the following reasons. First, smartphones provide an enabling platform which allows customers to install apps for various contextual needs; and second, smartphone apps offer the potential for technological resources to be integrated into individuals' lifestyles since smartphones often accompany individuals wherever they go. Access to a multitude of apps provides individuals with valuable operand resources that can enable them to pursue more varied lifestyles.

Design Of Measures
Perceived usefulness was adapted from the scale developed by Davis (1989) and measured by three items. Continuing IT use was captured by use frequencies of the 10 most popular smartphone apps: music player, GPS, weather, book reader, social

networking, news reading, watching video, dictionary, Internet browsing, and games. For each of the 10 apps, we asked the respondents to rate their use frequency on a seven-point Likert scale ranging from 'not currently use' to 'continuous use'. The ratings of the 10 apps for each respondent were then averaged to represent the overall app use frequency.

Contextual Variety and Means Drivenness were first developed in this study. To obtain better understanding of these two constructs, we conducted four focus groups with 32 smartphone users in Malaysia, Singapore and China. Focus groups can be particularly helpful in exploring user experiences as they allow meanings to emerge in a less directed way, and they are creative encounters in which participants share and test their ideas within the group (Pratt, 2000). During the focus group discussion, the participants were encouraged to share their smartphone experiences in various use situations. Findings from the discussions gave us insights towards the operationalization of the Contextual Variety and Means Drivenness constructs within the context of continuing technology use.

As discussed earlier, we define Contextual Variety as the degree of variability in the set of contexts which the individual faces in co-creating value through continuing IT use. The analysis of the focus group discussion revealed three main aspects of Contextual Variety: the *frequency of change* in purpose, urgency, and problem solving (see Appendix). Although environmental changes (e.g. time, location) and antecedent states (e.g. consequences of a user's mood or condition) were also mentioned while describing their use experience, their effects on user behaviors are deemed to be reflected by the three key aspects of a specific use context. In a similar vein as our measure of continuing IT use, each aspect was measured on a seven-point Likert scale from 'strong disagree' to 'strong agree' across the 10 apps. Their average was used as the score for each dimension.

Means Drivenness is defined as an individual's tendency to acquire new means (potential resources in context) and operationalized as the enhancement of user potential resources referring to the individual's evaluation of the perceived resource gain derived from technology use. Items used to measure Means Drivenness were extracted from the focus group study (See Appendix). All items were measured on seven-point Likert scales that ranged from 'strongly disagree' to 'strongly agree'. All the measures are presented in Table 1.

Data Collection

The survey was administered to Chinese smartphone users with the help of a major mobile network operator in China. The questionnaire was first developed in English and then translated to Chinese. The translation was evaluated by a panel of linguists as well as industry experts to ensure the consistency of meaning. The survey was conducted through the operator's online survey platform. Invitations were sent to 5,000 of its customers who use smartphones, and each participant could earn 10 bonus points in addition to a lottery of a free smartphone. A total of 1,526 respondents participated in the survey.

Three criteria were applied to examine the response validity. First, the respondents must be smartphone users, which disqualified 525 responses. Second, the respondents' smartphones should have all the apps that appear in the questionnaire. This excluded another 489 respondents. Finally, respondents should take at least 10 minutes to complete the questionnaire; any response shorter than that was considered invalid. Only five responses was removed based on this criterion. This validation process left 507 usable responses. The majority of the respondents (84%) were between 20-39 years old, with males accounting for 69%. More than three quarters held a college degree or higher qualification, and nearly 80% had more than one year's experience with their smartphones.

Results

Assessment of Measures

Confirmatory factor analysis (CFA) showed that all items were well loaded on their hypothesized constructs with loadings ranging from 0.820 to 0.955(χ^2 = 68.819, df = 32, χ^2/df = 2.151, NFI = 0.987, TLI = 0.990, CFI = 0.993, RMSEA = 0.048). All factor loadings were significant at p < 0.001. Scale reliability was measured by Cronbach alpha (CA) and composite reliability (CR). As shown in Table 1, all CA and CR values are above 0.89, indicating good internal consistency. Furthermore, average variances extracted (AVE) was calculated for each construct and all of them are higher than the 0.50 threshold. A complete list of factor loadings, CA, CR and AVE can be found in Table 1.

Table 1. Measurement Scales

Constructs	Factor Loadings
Contextual Variety (seven-point Likert scale: 1 = Strongly Disagree; 7 = Strongly Agree, AVE = 0.832, CR = 0.937, CA = 0.898)	
The purpose for using this app is different each time I use it.	.891
The level of urgency is usually different each time I use this app.	.885
I am usually trying to solve a different problem each time I use this app.	.820
Perceived Usefulness(seven-point Likert scale: 1 = Strongly Disagree; 7 = Strongly Agree, AVE = 0.909, CR = 0.968, CA = 0.950)	
I use apps because they help me become productive	.934
I use apps because they help me cope with life in general	.952
I use apps because they help me multi-task	.905
Means Drivenness (seven-point Likert scale: 1 = Strongly Disagree; 7 = Strongly Agree, AVE = 0.862, CR = 0.961, CA = 0.946)	
I try new apps because I need to know when I can use them.	.847
I try new apps to know what I can expect from it in the future when I use it.	.866
I try new apps to reduce my time needed to use it in the future (practice for time).	.945
I try new apps to reduce the effort needed to use it in the future (practice for effort).	.955
Continuing IT Use (seven-point scale: 1 = very rare use; 7 = continuous use)	
Frequency of using the app …	--

AVE = Average Variance Explained, CR = Composite Reliability, CA = Cronbach Alpha

Discriminant validity was assessed by comparing the square root of each construct's AVE with its correlations with all other constructs. A square root larger than the correlations indicates good discriminant validity. This was supported by the results in Table 2. Overall, the desirable psychometric properties of the measures were adequately satisfied.

Table 2. Correlations and Discriminant Analysis

	Mean	SD	CV	PU	MD	CU
CV	5.08	1.15	**0.912**			
PU	5.62	1.13	0.441	**0.959**		
MD	5.51	1.10	0.449	0.0758	**0.928**	
CU	5.04	1.20	0.389	0.359	0.367	--

1. CV = Contextual Variety, MD = Means Drivenness, CU = Continuing IT Use
2. Numbers in bold are square roots of AVEs corresponding to the specific constructs.
3. All correlations are significant at p < 0.001 (2-tailed).

Hypotheses Testing

AMOS 19 was used to test the structural model. As shown in Figure 1, the chi-square was significant at 0.001 level; however, this statistic could be seriously affected by sample size (Byrne 2010). An adjusted measure relative to the degree of freedom was then adopted. The results were satisfactory (χ^2 = 87.984, df = 39, χ^2/df = 2.256). All other fit indices were within the commonly acceptable ranges (NFI = 0.983, TLI = 0.987, CFI = 0.991, RMSEA = 0.05). Therefore, a good model fit was achieved.

The link from Contextual Variety to technology use was positive and significant (β = 0.276, p < 0.001), supporting H1. The relationship between Means Drivenness and technology use was positive and significant (β = 0.149, p < 0.05), providing support for H2. Contextual Variety was also positively associated with Means Drivenness (β = 0.117, p < 0.001), thus supporting H3.

To test mediation effects, the following four conditions should be met: (1) the independent variable significantly correlates with the dependent variable; (2) the independent variable significantly correlates with the mediator; (3) the mediator significantly correlates with the dependent variable; (4) with significant correlation between the mediator and the dependent variable, the previous significant correlation between the independent variable and dependent variable becomes insignificant (full mediation) or smaller (partial mediation) (Baron and Kenny 1986).

Based on these conditions, a reduced model without the mediators (i.e. Means Drivenness and Contextual Variety) was tested. The relationship between perceived usefulness and technology use in this model was 0.37 (p < 0.001). Hence, the first condition was met. According to the results of the proposed model in Figure 1, the two mediators were significantly associated with the independent variable (i.e. perceived usefulness) as well as the dependent variable (technology use). Thus

conditions 2 and 3 were also satisfied. The relationship between perceived usefulness and technology use was fully mediated by Contextual Variety and Means Drivenness since the direct link (i.e. from perceived usefulness to technology use) was no longer significant (β = 0.122, p < 0.1). The results suggested that both H4 and H5 were supported. Thus, all hypothesized relationships were supported.
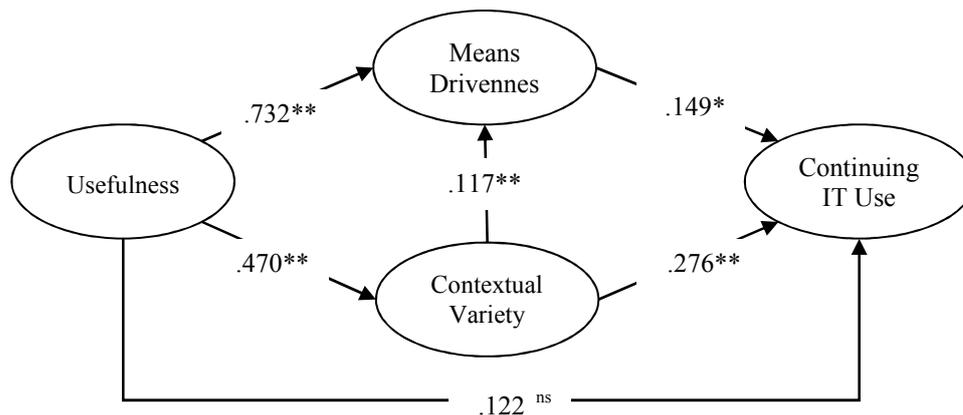
χ^2= 87.984, df = 39, p < 0.001, χ^2/df = 2.256, NFI = 0.983, TLI = 0.987, CFI = 0.991, RMSEA = 0.050
*p<0.05 (2-tailed), ***p < 0.001 (2-tailed)

Figure1. Structural Model

Discussion

Our study aims to investigate the importance of context-focused variables in the continuing use of technology. By using smartphones as an example of IT use, we widen the theoretical understanding of IT use in contexts through the two variables of Contextual Variety and Means Drivenness and test their existence within the mobile domain. We showed that as Contextual Variety increases, frequency of technology use increases, supporting H1. This suggests that contingent factors that lead to high Contextual Variety has an impact on use behavior. Such Contextual Variety that could occur across individual types compels individuals to better integrate resources for more varied outcomes. Our study also shows that increased Means Drivenness results in increased technology use, supporting H2. Consistent with effectuation logic, we therefore infer that the drive to have greater means would result in greater use as more varied and new goals emerge.

We find that when Contextual Variety is high, Means Drivenness increases (H3), suggesting that Means Drivenness is enhanced by contextual cues. Thus, as an individual's life becomes more dynamic and complex (high variety), he or she tends to be means driven, so as to increase their potential resources (means) to cope with more varied contexts, suggesting the use of effectuation logic by technology users. In addition, we found support for H4 and H5, suggesting that Contextual Variety and

Means Drivenness do indeed mediate the relationship between perceived usefulness and frequency of continuing use. This finding proposes that in continuing IT use, perceived usefulness is in itself context-moderated construct. Once context is controlled for, in terms of Means Drivenness and Contextual Variety, increasing the perceived usefulness of the technology does not drive frequency of continuing use. This supports a view where context manifests the 'problem to be solved' or the 'job to be done' (Christensen et al., 2007) and Contextual Variety is the manifestation of degree of 'jobs' or 'problems' complexity in an individual's lived life. This could also imply that continuing IT use may be context-specific, driven by contingent traits rather than user-enduring traits. Future research could investigate their influence across other IT platforms.

Our paper seeks to show the role of context within continuing IT use as proposed by S-D Logic when IT use is viewed as value co-creation. Our study also demonstrates the influence of effectual reasoning on continuing technology use. As discussed earlier, our choice of testing this within the mobile space is deliberate in that smartphone users exhibit a wide contextual range of variety in apps use in which to test our hypotheses. Goals could be predetermined or emergent, and outcomes could be varied or stable on a day-to-day basis. The results have shown that effectual reasoning could drive many different outcomes as individuals become more means driven. Read et al. (2009) also propose that new firms, new products and new markets come from entrepreneurs being means driven. Our investigation shows that the difference between 'what should I do to achieve this goal' (causal logic) and 'what can I do with these means' (effectuation logic) also has over-arching implications on how individuals continue to use technologies. To some extent, we argue that this accounts for why the iPhone and an apps-driven culture have taken off globally.

However, our study does not discuss what resource is being integrated and how context changes the nature of resource. Research in interpersonal resources (e.g. Adelman and Ahuvia 1995) and sociologically complex resources could be relevant here.

Practical Implications

In marketing, segmentation is still widely practiced but often, segmentation practices tend to profile user types, rather than use-types. With technological advancement, our study shows that context may be a more accurate unit of analysis for segmentation since high Contextual Variety of IT use may lead to inaccurate user profiling. This implies that the future of understanding the frequency of continuing technology use could rest in firms seeking to understand contexts rather than merely users. Therefore, future segmentation models should be more concerned with not just who the individuals are, but the contexts in which they create value from IT use i.e. when, where and how customers are using technologies and connecting with whom. Context profiling could be the next phase of market advantage. This will be assisted by greater technological advancement in IT, with more digitized data being available – location-based, Radio Frequency Identification (RFID) tagging –which

could provide more information on use and contexts and valuable insights into the value co-creation activities of individuals in such contexts. It is no wonder then that Oracle, IBM, Microsoft and SAP between them have spent more than $15 billion buying software firms specializing in data management[1]. With greater visibility of context, new ways to serve, new products designed for connectivity and new business models will arise that will enable and empower individuals to achieve hyper-variety outcomes. Normann (2001) describes 'density' as the best combination of resources mobilised for a particular context such as a particular customer at a given time and place. Ultimately, density means that customers could have a whole world of specialist knowledge available when and where they like, with the potential to incorporate knowledge available only to themselves. Density is increasingly enabled by technology, which liberates the world from constraints of time (when things can be done), place (where things can be done), actor (who can do what) and constellation (with whom it can be done).

Moreover, our study shows that effectual logic could be employed when goals are emergent, contributed by high Contextual Variety. More Means Drivenness coupled with technological advancement could spawn greater empowerment of the individual, as more varied outcomes become achievable in a greater variety of contexts. Already, IT advancement is liberating a workforce that is able to work at different times and places according to when and where is most suitable for them. Employees can clear their email inboxes and work on projects, papers and reports on the move, at home or even in bed because technology has allowed them to choose the most effective and appropriate moments to do various kinds of work to match different types of environment. Technology has also allowed the aged to live independently at home, on a yacht, or wherever they choose, with sophisticated methods of communicating, diagnosing, sharing and gaming. Such resourcefulness and the lifestyles individuals seek are part of the changing urban environment and whose evolving needs would drive new markets for innovation.

Conclusion

The emergent S-D Logic literature provides a framework to think about continuing technology use as value co-creation between technology providers, individuals and other stakeholders integrating resources. Such co-creation occurs not merely in market spaces but even in the broader ecological system where markets may not yet have been formed, but where actors transform resources to achieve value for themselves within them (Arnould, 2008; Vargo and Lusch 2004, 2008). IT plays a big role in connecting, integrating and empowering individuals to be means driven and to achieve varied outcomes.

Our study showed that Contextual Variety and Means Drivenness mediated perceived usefulness in technology use. Specifically, we emphasize the role of context-in-use behavior and the application of effectual reasoning through Means Drivenness when goals of technology use are uncertain. We hope our work would

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[1] "Data, Data, everywhere," The Economist, Feb 25, 2010

spur greater interest in context research and effectual logic in information technology value co-creation. The digital economy is generating petabytes of data, capturing multiple contexts of continuing technology use. In an interconnected society of greater interdependencies between individuals, societies, technologies, how resources are integrated and how value is created is of importance to the future of urban living.

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Category	Code	Example Quote	Interviewee
Contextual Variety	Problem solving	Shopping at the supermarket, when you want to really quick do a check on what is this thing for especially let's say food or vitamins. What's this thing really good for and you can go online and check. It will give answer straight away. You can't go back.	Male, Business Executive, Malaysia
		Once I went into a street where I had never been and I wanted to find my way out, but I couldn't even tell where I was. Suddenly I realized that I could use a map via mobile. Finally, I found my way with its help.	Female, Professional China
	Urgency of situation	Once the gas container upstairs was at risk of exploding, all the electricity in the building has been cut off. My mum and I wanted to run downstairs as soon as possible, but it was quite dark. Suddenly, I realized my phone could give us a light, and then we run out of the building with the help of its light.	Male, Student, China
	Purpose of use	I've got a lot of friends that always argue about stuff so this TV series was acted by this guy or something like that so you're just trying to settle an argument and Wikipedia is on my mobile, it has settled a lot of arguments.	Female, Professional, Malaysia
		When I was in Secondary school, the class was quite boring. Suddenly, I thought that I could play games with my classmates if our phones could be connected by Bluetooth. From then on, we played a lot.	Male, Student, China

Means-drivenness		When I was in school, car doors could be opened at a distance of 20 to 30 meters by its remote control. But it is impossible if the distance was greater than that. My classmate told me that if two mobiles were connected together, this could be achieved however far it was. (Did you have a try?) Yes, several times. But it didn't work.	Male, Student, China
		Yeah because I've never tried. I mean like, somebody told me you can actually look using the phone. I've never tried and I said, "Why not give it a shot?" So I was just playing around, trying to access the internet and, "Ha, I did it, I've found it." OK.	Female, Professional, Malaysia
		I use it for reading for the first time on the move. Because when I get the phone, I didn't have 3G plan so I knew the phone has a GPS, I didn't use it that much but then I realized it has a Office reader and PDF reader so before I left my office, I transferred some of my files, the PDF or documents into my phone. That's the first time I used it	Male, Professional, Singapore