Adaption-Innovation at Work: A New Measure of Problem- Solving Styles

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Abstract

The study introduces a new measure of adaption versus innovation problem solving style (labelled the AI-W) that is validated using professional accountants. The AI-W consists of nine items and non-proprietary in comparison to the Kirton Adaption-Innovation Inventory (KAI) of 32 items which is proprietary.

An analysis of data from a large sample of practicing accountants suggests that reliability, construct validity, and discriminant validity are high. As expected, the AI-W is not highly correlated with dimensions of the Big-Five personality types. The study also shows that accountants in general prefer an adaptive problem solving approach to an innovative approach and that auditors and tax preparers tend to have more adaptive scores than consultants and system personnel. The implications of the study are also discussed.

Keywords:

Problem-solving Style
Adaption
Innovation
The AI-W scale

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Introduction

The objective of this study is to introduce a concise measure of individual problem-solving style that is freely available for application in academic research and in organizational settings. The study is based on Adaption-Innovation theory that posits that individuals differ in terms of their problem-solving approach along a continuum ranging from adaptive behavior to innovative behavior (Kirtion, 1976, 1984, 1994). Adaptors exhibit a strong preference for working within existing methods and structures, whereas innovators seek novel solutions and may ignore existing conventions. Studies examine adaption versus innovation against a variety of personality traits (e. g. Kirton and De Ciantis, 1986) and across multiple populations and cultures (Loo and Shiomi, 1997). Google Scholar lists 533 citations to the seminal 1976 paper alone.

While Adaption-Innovation is more extensively applied by consultants in organizational settings and in clinical research, some academic accounting studies have used the theory to investigate the problem-solving style of accounting educators, accounting students, and certified public accountants (e.g. Wolk and Cates, 1994; Wolk, Schmidt and Sweeney, 1997; Gul 1986; Summers, Sweeney and Wolk, 2000). More recent studies (e.g., Xu and Tuttle, 2005; Emsley, Nevicky and Harrison, 2006) apply adaption-innovation theory to managerial accounting contexts. Xu and Tuttle (2005), using professional MBA students as subjects, investigate whether similarities in adaptive or innovative work style between a manager and a subordinate influence the manager's causal attributions and subsequent performance evaluations for the subordinate, given accounting performance indicators. Their study provides initial evidence that interpersonal factors such as work style similarity moderate how managers use accounting information when they make performance evaluation decisions. Emsley et al (2006) investigate the impacts of adaptive and innovative style on the initiation of radical and non-radical management accounting innovations and find that management accountants with a more innovative style tend to initiate more radical innovations than accountants with a more adaptive style. To

our knowledge, only one study has examined problem-solving style of public accountants in audit and consulting functions (Summers et al., 2000). It is likely that research in accounting that applies adaption and innovation theory has been limited, not so much by a lack of research questions, but rather by the proprietary nature of the existing sole measure of adaption-innovation style, the KAI inventory.[1] There exists a need for an alternative measure of adaptive versus innovative problem-solving approach.
This study introduces a short and essential measure of workplace adaptor-innovator problem-solving style consisting of only nine items. We label our measure the AI-W scale (Adaptor-Innovator in the Workplace). Our objective is to make this alternative measure freely available to the academic community, thereby facilitating future research in this area. We note that existing research shows that the KAI is not a homogeneous, unidimensional measure of cognitive style but rather consists of three sub-dimensions: Approach to Efficiency (AE), Rule Governance (RG), and Sufficiency of Originality (SO) (Foxall and Hackett, 1992). Building upon previous research (e.g. Summers et al., 2000; Bagozzi and Foxall, 1995; Kirton, 1976; Xu and Tuttle, 2004), our nine-item measure of the AI-W consists of the same three sub dimensions. We employ a confirmatory factor analysis to investigate the factor structure of the AI-W and to assess its reliability and validity using large samples of professional accountants and various statistical approaches. To establish discriminant validity between our AI-W measure and other constructs, we investigate the relationship between the AI-W and well-established personality trait measures. The results show that the new AI-W scale is reliable and possess satisfactory construct validity.

The study is important to researchers and to accountants for several reasons. First, while maintaining reliability and validity, the nine-item AI-W measure developed in the current study is considerably shorter than the Kirton's scale. The length of the original 32-question KAI inventory prevents its use in many research contexts, particularly those where subjects' time is limited or expensive. Such limits are an important and sometimes a critical consideration when conducting academic research in practice settings. In the case of studies administered through the mail or via the Internet, the length of the instrument can severely and negatively impact response rates (Dillman, 2007). Second, more research in accounting including management accounting is needed to investigate the impact of adaption-innovation problem-solving style on accountants' judgment and decision-making. Little is known about possible interactions between problem-solving style and knowledge, expertise, decision patterns, and other contextual factors in management accounting settings. Third, today's management accountants work in a more dynamic and changing environment facing an increasing number of innovations. Hence, an awareness of problem-solving styles is necessary to understand how management accountants deal with changes and with team members who differ in problem-solving approach.

Background

The concept of personality includes individual differences in cognitive styles, or the manner in which individuals prefer to perform mental actions (Goldsmith, 1994). One such theory, proposed by Kirton (1976), is the theory of Adaption-Innovation problem-solving style. According to the theory, adaptors tend to seek solutions that apply accepted, normal procedures whereas innovators offer novel solutions that change the context. Adaptors rely more on generally agreed upon criteria. They prefer to initiate changes that improve current ways of doing things. Innovators, by contrast, tend to work outside the boundaries of accepted paradigms and prefer to initiate changes based on different ways of doing things. That is, the adaptor style is characterized by a preference to "do things better" whereas the innovator style is characterized by a preference to "do things differently" (Kirton, 1976, p. 622).
Kirton not only conceptualized the theory of adaption and innovation problem-solving style but also developed the Kirton Adaption-Innovation Inventory (KAI) to measure differences in such cognitive styles (Kirton, 1976). The KAI is a 32 item questionnaire on

[1] The use of the KAI in academic research has been greatly limited because of its proprietary nature. According to the terms and conditions of its use (www.kaicenter.com December 20, 2010) the KAI can only be administered by a "certified practitioner".

which a respondent specifies the degree of ease or difficulty of maintaining various adaptive or innovative approaches.

Early studies treated the KAI as a unidimensional construct (i.e. by summing across all 32 items). Following substantial evidence using exploratory factor analysis from a number of studies, however, researchers began to challenge this unidimensional assumption in strong support for three sub-dimensions associated with the KAI (e.g., Bagozzi and Foxall, 1995; Taylor, 1989). The first dimension is labeled *Approach to Efficiency* (AE). Within this dimension adaptors prefer to progress incrementally towards a defined goal, while innovators avoid painstaking attention to detail. The second dimension is *Rule Governance* (RG). With respect to this dimension, adaptors typically restrict their behavior to socially acceptable actions while innovators tend to ignore established rules and conventions. The third dimension is *Sufficiency of Originality* (SO). Within this dimension, adaptors present a few, typically implementable solutions to a problem while innovators propose many, possibly impracticable, solutions.

Behavioral studies have related the KAI to various measures of personality type and style including the Myers-Briggs Type Indicator (MBTI) (for a review see Isaksen, Lauer and Wilson, 2003), the NEO Personality Inventory (Costa and McCrae, 1992), and the Big-five personality types (e. g. McCrae and Costa, 1987, De Raad, 2000). In general, KAI total scores show moderate correlation (r = 0.40 to 0.66) with the sensing-intuitive dimension of the MBTI and with the judging-perceiving dimension (r = 0.40 to 0.53) across the studies reviewed by Isaksen et al (2003).

In addition, several Big-Five personality types (extraversion, agreeableness, conscientiousness, openness to experience and neuroticism) have been found to be relevant to adaption-innovation in a variety of work related contexts (De Raad, 2000). For example, studies show that extraversion is a predictor of individuals who enter certain occupations (Barrick and Mount, 1991). Accordingly, Kwang and Rodrigues (2002) explore the relationship between adaption and innovation as measured by the KAI and the Big-Five personality types. Adaptors were significantly more conscientious than innovators; and the innovators were significantly more extraverted and open to experience than adaptors. It is important to note that the personality type of openness appears to be more specific to problem-solving contexts. For example, openness has been shown to be related to learning processes (cf. Blickle, 1996). Since openness includes characteristics such as creativity and imaginativeness which, to certain extent, overlaps the AI-W problem-solving styles, it is likely that measures of the AI-W and measures of openness in Big-Five personality type will be correlated.

While the adaption-innovation construct may be correlated with certain measures of personality, it does not purport to account for patterns of behavior across all situations. Rather, adaption and innovation is more concerned with styles of problem-solving in an organizational setting and provides a partial explanation for organizational behavioral differences in problem-solving and decision-making (Goldsmith, 1994).[2] As a consequence, the theory has been widely applied in organizational settings and in internal organizational research, and problem-solving style has been found to be correlated with occupational choice in general population. Secretaries, bankers, and accountants tend to be adaptive while individuals in marketing and finance are more innovative (e.g. Holland, Bowskill and Bailey, 1991). Research also suggests that both adaptors and innovators are needed by organizations because they each have their own strengths and weaknesses. Within a team or group, the adaptor's weakness may be the particular areas of the innovator's strength and vice versa (e.g. Kirton, 1994).

Much of the adaption and innovation research in accounting focuses on accounting students' problem-solving style and comparison of accounting students with other business majors or with accounting educators in their problem-solving styles (e.g. Wolk and Cates, 1994; Wolk, Schmidt and Sweeney, 1997; Gul, 1986). The literature suggests that accounting students are more adaptive in their problem-solving style than other business majors (Wolk

[2] Some studies suggest that adaptors and innovators do not exhibit differences in preferences. For example, Dew (2009) finds similar preferences or contradictory responses between adaptors and innovators in some organizational decision contexts.

and Cates, 1994) and the adaption-innovation problem-solving style dimension is related to accounting students' interests and career preferences (Gul, 1986).

Summers et al. (2000) adapts the underlying theoretical constructs of adaption-innovation theory to the workplace of public accounting firms. They examine the problem-solving styles of public accountants in consulting and audit functions and investigate how the different problem-solving styles of auditors and consultants impact job fit in the workplace, which in turn affects job satisfaction and turnover intentions. While Summers et al. (2000) apply the adaption-innovation theory to a specific workplace situation; they continue to use the 32-item KAI to measure the problem-solving styles of their subjects. Xu and Tuttle (2004, 2005) build on the work of Summers et al. (2000) to create a new seven-item adaptor-innovator measure. The seven items in their new measure correspond to the seven constructs identified by Summers et al. (2000 Table 1, p 4) as the essential differences between adaptive and innovative problem-solving style in the workplace. Xu and Tuttle use four samples to assess the reliability of the new adaptor-innovator scale. The four samples include business sophomores, junior accounting majors, senior accounting majors, and MBA students. Cronbach's Alpha (Cronbach, 1951) for the seven-item measure for the four samples is 0.753, 0.810, 0.850, and 0.920, which suggests a high degree of reliability that improves as the sample population progresses from sophomore to graduate status. One likely explanation for this increase in reliability is that individuals become more aware of their problem-solving approach as they gain experience working with others.

Xu and Tuttle find, however, that the seven-item scale is one-dimensional. Exploratory factor analysis revealed single factor eigenvalues ranging from 2.95 to 4.10 across samples. According to the previous research (e. g. Anderson and Gerbing, 1988, Hatcher, 1994), latent factors should normally be assessed with at least three items. Thus, we conclude that the seven-item scale contains too few items to reliably reflect all three sub-dimensions generally observed in the KAI and that at least nine items are needed to reliably represent a three factor model.

In order to develop and validate a concise yet comprehensive three-dimensional measure of adaptor-innovator problem-solving style, the present study adds two additional items thus creating a nine-item measure. We then administer the new scale to a large sample size of working certified public accountants in the U.S. We conduct confirmatory factor analysis and investigate the following psychometric elements of the scale: the reliability of the three factors, the convergent validity of scale measures, the discriminant validity of each measure within each factor, and the discriminant validity between measures of each factor and measures of constructs other than adaption-innovation.

Method

Measures

A nine-item scale of the AI-W is developed to measure problem-solving styles indicative of an adaptive versus innovative orientation. The AI-W scale is based on the description of characteristics of adaption and innovation styles by Summers et al (2000) and as implemented by Xu and Tuttle (2004, 2005). We extend the Xu and Tuttle scale from seven items to nine items in order to increase the reliability of the sub-dimensions of adaption-innovation as shown in Appendix I. The two additional items are: (1) I prefer to progress incrementally towards a defined goal (I cannot tolerate following routines and structure all the time); and (2) I prefer to present few solutions which I know will be feasible (I like to propose many solutions, although some may turn out be impractical). Each pair of statements represents two different approaches to problem-solving in the workplace and reflects the contrasting characteristics of individual styles in terms of approach to efficiency, rule governance, and sufficiency of originality. Participants were asked to indicate their problem-solving style by circling one number that corresponds most closely with how they think about themselves when solving problems in the workplace. The AI-W measure is a bipolar nine-point scale with an adaptor or innovator description at each anchor. Subjects' responses range from 1 to 9. Total scores on the AI-W should be viewed as

Table 1: Participant Demographics

Panel A:			
Demographic Variables	***Number of Participants***	***Demographic Variables***	***Number of Participants***
Gender		*Race*	
Male	264	African-American	31
Female	253	American-Indian	4
		Asian	12
Age		Caucasian	451
21 and 30	57	Hispanic	15
31 and 40	78	Other	4
41 and 50	167		
51 and 60	165		
61 and 70	43	*Organization*	
over 71	7	CPA firm	228
		Industry	116
Primary area of work		Government	145
Audit	101	Non-profit	28
Internal audit	17		
Financial	124	*Number of years as CPA*	
Consulting	25	Non CPA	29
Tax	112	less than 10 years	149
Managerial	60	10 and 20 years	158
Info System	7	21 and 30 years	129
Multiple areas	56	31 and 40 years	44
Other	15	over 40 years	8
Panel B:			
Demographic Variables			***Mean***
Years of full time work			22

representing greater or lesser degrees of either an adaption or innovation problem-solving style. Compared to the KAI which consists of 32 items, the AI-W scale with only nine items is brief within the constraint that each sub-dimension contains at least three indicators.

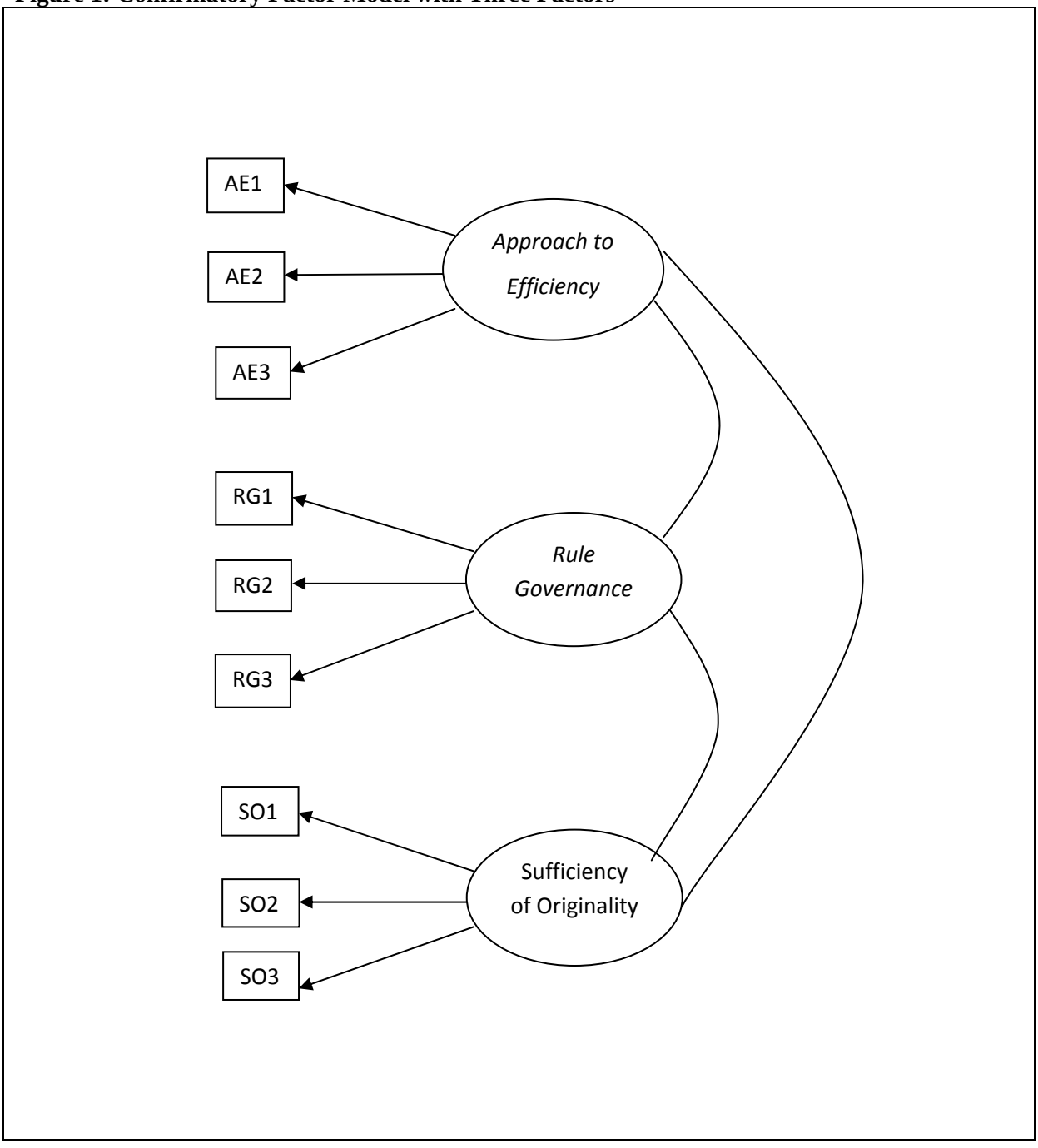
Subjects and Procedures

We asked 538 certified public accountants (CPA) to participate in the study. The accountants came from different organizations in the U.S. Of the 538 responses, 21 were incomplete leaving 517 usable responses. Table 1 displays participant demographics. As shown, there were 264 males and 253 females, the majority of participants were between 41 and 60 years old, most of them work in public accounting firms, and the average number of years worked was 22.

The questionnaire consists of three parts. The first part is a nine-item scale of the AI-W as described in the previous section. The second part consists of the 40 items of the Big-Five personality inventory based on Saucier (1994). Participants were asked to indicate how accurately each adjective describes themselves (1 = very accurate, 7 = very inaccurate) as they generally or typically are at the present time,

not as they wish to be in the future. There were 40 alphabetically listed adjectives, such as bold, careless, deep, inefficient, shy, and warm; measuring personality traits of Extraversion, Agreeableness, Conscientiousness, Neuroticism, and Openness. The final part elicits demographic information about participants.

Figure 1: Confirmatory Factor Model with Three Factors



Confirmatory Factor Analysis

The use of confirmatory factor analysis allows an explicit test of the theoretical factor structure of the AI-W scale (Bagozzi and Foxall, 1995)[3]. Figure 1 presents the confirmatory factor model examined in the study. The model consists of three latent factors related to *Approach to Efficiency* (AE), *Rule Governance* (RG), and *Sufficiency of Originality* (SO) each containing three measured indicators. The indicators (e. g.

[3] We also performed exploratory factor analysis to identify the factor structure underlying a set of factors. The nine items and corresponding factor loadings are presented in Table 5.

AE1 and AE2) represent items loaded on the respective factors (i.e. treating each item as an individual indicator of its appropriate factor). This complete disaggregative approach is sensitive to measurement error, making it more difficult to obtain an acceptable fit of the model and thus providing a strong test of model validity.

Results

Model Fit

A number of goodness-of-fit indices were examined to evaluate model fit. These indices include the ratio of the chi-square value to degrees of freedom (χ^2/df), which has the recommended cutoff value of 2.0 (Hoetler, 1983); root-mean-square error of approximation (RMSEA), which has the maximum level of 0.06 (Hu and Bentler, 1998); the Bentler-Bonett Non-Normed Fit Index (NNFI), the Bentler Comparative Fit Index (CFI), and the Goodness of Fit Index (GFI), which have the minimum level of 0.90 (e.g. Bentler and Bonnett, 1980) or 0.95 (Hu and Bentler, 1998).[4]

We first analyze a three-factor confirmatory factor model which is the object of the study. The results are reported in Table 2. The analysis demonstrates that the three-factor model fits the data as χ^2/df ratio and RMSEA are 1.708 and 0.038 respectively, which are below the maximum acceptable fit indices of 2.0 and 0.06 (Hu and Bentler 1998). In addition, NNFI, GFI, and CFI are 0.980, 0.983, and 0.987 respectively, which are above the minimally acceptable fit indices of 0.90 (e.g., Bentler and Bonett, 1980) and 0.95 (Hu and Bentler, 1998). Together, the findings show that the three-factor model provides a good fit to the data.

Because we predict that the three factors underline the AI-W, we expect that the single-factor model will not fit the data. Table 2 also displays the results of the single factor model. In this case, the χ^2/df ratio and RMSEA are 12 and 0.148, respectively, which are well above acceptable levels. The values for indices of NNFI, CFI, and GFI range from 0.689 to 0.864 and indicate that the single-factor model leaves considerable variance unexplained. Consistent with our expectations, the single-factor model of the AI-W does not fit the data.

Reliability and Convergent Validity

We now assess the reliability of the latent constructs and individual indicator variables (Hatcher 1994). We examine indicator reliability using the square of the correlation between each indicator and its latent factor. Table 3 presents the results for reliability tests. As shown in Table 3, column 4, six indicators display reasonable reliability with values between 0.465 and 0.637 but three indicators reveal relatively low reliabilities (i.e. between 0.307 and 0.416). We therefore examine composite reliability to determine whether the individual reliabilities are unacceptably low. Composite reliability in a confirmatory factor analysis assesses the internal consistency of the indicators that measure a given factor and is similar to coefficient alpha in exploratory factor analysis. For composite reliability, 0.60 is considered the minimally acceptable level of reliability for instruments used in research (Hatch, 1994). Composite reliability is calculated based on the following formula (Fornell and Larcker, 1981):

$$\text{Composite reliability} = \frac{(\Sigma L_i)^2}{[(\Sigma L_i)^2 + \Sigma \text{Var}(E_i)]}$$

Where:
L_i = the standardized factor loadings for that factor
Var (E_i) = the error variance associated with the individual indicator variables

The results of composite reliability are reported in Table 3, column 5. Composite reliability for all three factors (AE, RG, and SO) exceed 0.70 and the minimally acceptable level of reliability, suggesting satisfactory reliability has been attained.

Convergent validity is assessed as the degree to which indicators intended to measure the same construct are related (Hatcher, 1994). We assess convergent validity by examining the factor loadings in the confirmatory factor analysis. According to Anderson and Gerbing

[4] We report the ratio of the chi-square value to degrees of freedom (χ^2 /df) rather than the *p* value of the chi-square test (χ^2 test) which is sensitive to sample size. With large samples, the p value of χ^2 test will frequently be significant even if the model provides a good fit (James, Mulaik & Brett, 1982).

(1988), significant *t*-tests for the factor loadings provide evidence that all indicators are effectively measuring the same construct. Table 3 presents the standardized factor loadings (column 2) as well as the corresponding *t*-statistics (column 3). As shown in Table 3, *t*-statistics range from 11.55 to 18.31, indicating that each indicator's estimated pattern coefficient on its construct factor is significant thus supporting the convergent validity of those indicators.

Table 2: Fit Indices of the Model

Model	χ^2	*df*	χ^2 / *df*	*RMSEA*	*NNFI*	*GFI*	*CFI*
Single Factor Model	332	27	12	0.148	0.689	0.864	0.767
Three Factor Model	41	24	1.708	0.038	0.980	0.983	0.987
N = 517; RMSEA = root mean square error of approximation; NNFI = non-normed-fit index; GFI = goodness of fit index; CFI = comparative fit index.							

Table 3: Reliability and Convergent Validity

Constructs and Indicators	*Standardized Loading*	*Indicator t - value*	*Indicator Reliability*	*Composite Reliability*
Approach to Efficiency				0.733
AE1	0.682	15.48	0.465	
AE2	0.595	13.20	0.354	
AE3	0.790	18.31	0.624	
Rule Governance				0.780
RG1	0.753	18.01	0.568	
RG2	0.758	18.16	0.575	
RG3	0.697	16.34	0.485	
Sufficient of Originality				0.709
SO1	0.554	11.55	0.306	
SO2	0.798	16.13	0.637	
SO3	0.645	13.39	0.416	
**All t-tests for factor loadings are significant at $p < 0.001$.*				

While we are unable to directly examine the correlation between responses to the new AI-W scale with responses to the KAI, we obtain some information about construct validity by comparing our results with those of Taylor (1989). Taylor used the KAI to assess a three-factor model and drew samples from two sources. Group A consisted of 119 graduate staff from the research departments of four large manufacturing companies.
Group B consisted of 186 part time graduate students in a DMS/MBA program.

The findings in Taylor's study are displayed in Table 4. As shown, the factor structure and loadings of the three-factor model are similar between the two subsamples (i.e. Group A and Group B) and the combined sample (i.e. Group A and Group B combined, n = 305). Our following analysis in this study is based on a comparison of Taylor's combined sample results and our AI-W results.

Table 4: Taylor's (1989) Three Factor Model Using the KAI

		Combined n = 305			***Group A n = 119***			***Group B n = 186***		
Item	*Description*	*AE*	*RG*	*SO*	*AE*	*RG*	*SO*	*AE*	*RG*	*SO*
25	Is methodical and systematic	**.81**			.79			.82		
14	Is thorough	**.76**			.78			.74		
22	Masters all details painstakingly	**.56**			.48			.62		
4	Enjoys detailed work	**.56**			.57			.53		
17	Is consistent	.49			.46			.51		
28	Imposes strict order	.43			.51			.42		
2	Conforms		**.63**			.65			.62	
30	Fits readily into 'the system'		**.57**			.65			.53	
7	Never acts without proper authority		**.57**			.57			.55	
6	Is prudent dealing with authority		**.52**			.57			.52	
8	Never seeks to bend/break rules		**.50**			.51			.46	
20	Readily agrees with the team		.41			.44			.37	
29	Likes precise instructions		.41			.48				.40
32	Prefers colleagues who don't 'rock the boat'		.40			.49				.43
27	Works without deviation…		.38			.55		.42		
33	Is predictable		.36			.44			.31	
9	Likes consistent patterns		.29			.35		.24		
12	Likes to very set routines…		.26			.42		.25		
23	Proliferates ideas			**.71**			.71			.71
21	Has original ideas			**.67**			.76			.62
11	Has fresh perspectives on old problems			**.67**			.66			.67
16	Copes with many ideals simultaneously			**.65**			.61			.68
19	Is stimulating			**.56**			.59			.53
26	Often risks dong things differently			**.54**			.46			.60
3	Will always think of something…			.45			.45			.47
24	Prefers to work on one problem			.45			.51			.41
15	Is (not) a steady plodder			.42	.32					.43
18	Can stand out in disagreement			.41		.34				.51
31	Needs stimulation of frequent change			.36			.25			.49
5	Would sooner create than improve			.34			.36			.33
10	Holds back ideas till needed			.34			.24			.41
13	Prefers gradual change			.25			.36	.24		

We use the same factor analysis method as in the Taylor's study (i.e. maximum likelihood with varimax rotation). The factor loadings for each of our nine items are presented in Table 5. All of the nine factor loadings in our AI-W scale are greater than 0.50 (shown in Table 5) while only 15 of the 32 items of the KAI in the Taylor's finding have loadings greater than 0.50 (shown in Table 4). When we compare the nine items in our study with those 15 items which exceed the loading of 0.50 in Taylor (1989), we find a similar factor pattern and, more importantly, comparable description of items between our AI-W and the KAI for all three dimensions or factors (AE, RG, and SO). For example, the descriptions of the three items loaded on RG in the AI-W are: (1) I perform best in situations where well-established rules exist (I like to tackle situations where no rules exist); (2) I seek to solve problems with tried and accepted means (I do not rely on accepted means to solve

problems); and (3) I value continuity, stability, consensus, and group unity (I am not always reverent of consensus, custom, and group norms). As displayed in Table 4, five of the 12 items in the KAI loaded for RG exceeding 0.50 are: (1) Conforms; (2) Fits readily into 'the system'; (3) Never acts without proper authority; (4) Is prudent dealing with authority; and (5) Never seeks to bend/break rules. Based on comparisons of studies, it appears that the three sub-dimensions in our AI-W measure substantially the same constructs as in the KAI.

Discriminant Validity

Discriminant validity refers to the extent to which the indicators that are used to measure one construct are uncorrelated with indicators that measure other (but perhaps related) constructs (Hatcher, 1994). We first examine the within scale discriminant validity of the three sub-factors (AE, RG, and SO) of the AI-W. This is done by performing a series of chi-square difference tests comparing a model that constrains the correlation between the factors to be equal to 1.0 with an unconstrained model in which correlations are estimated. The results show that chi-square values in all three pairs are statistically higher ($p < 0.001$) for the constrained model than for the unconstrained model suggesting that three factors are distinct and that discriminant validity is achieved between the three sub-dimensions.

We also examine discriminant validity between the three-factor AI-W and the major components of the Big Five of personality types by reviewing correlations between the two sets of measures. Table 6 presents the results. As shown, the correlations between the two measures vary significantly. The correlations between constructs in the AI-W and measures of Openness are significant but low, ranging from $r = -0.180$ ($p < 0.0001$) to $r = -0.333$ ($p < 0.0001$) while the correlation between the AI-W and Extraversion is insignificant (between r = -0.111 and r = -0.161). All correlations are in the expected direction.[5] The negative coefficients for the relationship between the AI-W and Openness or Extraversion suggest that subjects with more Openness and/or Extraversion personality traits are more innovative (or less adaptive). As discussed earlier, due to some common features underlying the AI-W and Openness and Extraversion, a finding of low but significant correlation is not unexpected. For instance, some characteristics of Openness such as creativity or imaginativeness overlap the AI-W problem-solving styles thus resulting in a low but significant correction between the two. The multidimensional nature of Extraversion also has relevance and plays a role in work-related contexts.

In addition, the correlation between the AI-W and Neuroticism (defined as emotional stability including characteristics such as anxious, sensitive, relaxed, and stable) is not at all significant across all measures (AE, RG, SO) ranging from $r = -.0227$ ($p = 0.6067$) to $r = 0.0762$ ($p = 0.1122$). Further, measures of both Agreeableness and Conscientiousness are not correlated with measures of *Sufficiency of Originality* (SO) with $p = 0.417$ and $p = 0.217$, respectively.

On the other hand, Conscientiousness is positively related to *Approach to Efficiency* ($r = 0.264$, $p = 0.0001$). This correlation is not a surprise. Under AE, Adaptors can do routine work for long periods and prefer to progress incrementally towards a goal whereas innovators avoid painstaking attention to detail and following routines and structure. Hence, this dimension is, to some extent, consistent with the characteristics of conscientiousness including being organized, systematic, and efficient. We conclude that sufficient discriminant validity exists between the AI-W and components of the Big Five personality types to permit independent application of the AI-W in academic research settings.

[5] The scale for the Big Five personality is from 1 to 5 (1 = "very accurate" and 5 = "very inaccurate"). In other words, 1 suggests that subjects have the highest degree of Openness, Extraversion, Conscientiousness, Neuroticism, and Agreeableness and 5 indicates subjects have the lowest degree of those personality traits.

Table 5: Three Factor Model Using the AI-W

Item	Description	AE	RG	SO
AE1	I am disciplined, precise, and methodical in my approach to solving problems. (I am creative and like to approach tasks from unusual angles.)	**.51**	.38	.13
AE2	I can do routine work for long periods. (I avoid painstaking attention to detail.)	**.59**	.16	.12
AE3	I prefer to progress incrementally towards a defined goal. (I cannot tolerate following routines and structure all the time.)	**.76**	.32	.10
RG1	I perform best in situations where well-established rules exist. (I like to tackle situations where no rules exist.)	.27	**.68**	.18
RG2	I seek to solve problems with tried and accepted means. (I do not rely on accepted means to solve problems.)	.25	**.69**	.17
RG3	I value continuity, stability, consensus, and group unity. (I am not always reverent of consensus, custom, and group norms.)	.23	**.65**	.13
SO1	I am more concerned with resolving problems than finding them. (I like to identify problems and find new avenues of solution.)	.01	.19	**.53**
SO2	I like to produce few ideas, generally aimed at improving the existing system. (I like to produce numerous ideas, generally aimed at changing the existing system.)	.14	.11	**.78**
SO3	I prefer to present few solutions which I know will be feasible. (I like to propose many solutions, although some may turn out to be impractical.)	.15	.07	**.62**

AE = Approach to Efficiency
RG = Rule Governance
SO = Sufficiency of Originality

Additional Analyses

In an attempt to further validate the AI-W, we perform additional analyses to determine whether AI-W scores differ among subsets of the accountants in ways similar to those typically observed using the KAI. Table 7 presents mean scores partitioned by selected demographic information. As shown in Table 7, the mean score of the AI-W across all subjects in this study is 4.29 suggesting that accountants in general may prefer an adaptive problem-solving approach to an innovative approach. This evidence is more pronounced for AE (mean = 3.57) and RG (mean = 3.87). These results appear to be remarkably consistent with that of Summers et al (2000) using the KAI. The findings in the study of Summers et al (2000) show that, among the three subscales of the KAI (E, R, and SO, equivalent to our AE, RG, and SO), the mean scores for E (i.e. AE) are lowest while the mean scores for SO are highest for auditors and consultants.

The results also indicate that female accountants are more adaptive in the problem-solving than their male counterparts. This is shown by their average AI-W score (mean for male = 4.49, mean for female = 4.10, p = 0.0002) and also on AE (mean for male = 3.97, mean for female = 3.52, p = 0.0014) and RG score (mean for male = 4.14, mean for female = 3.59, p = 0.0002).

Our data using the AI-W also reveal that auditors and tax preparers have more adaptive scores on all three factors than consultants and accountants working in information system. This corresponds closely to Summers et al. (2002) who conclude that consultants have a significantly greater preference for creative ideas than do auditors. Likewise, tax preparers are steeped in standards, regulations, enacted laws and rules. Conversely, information system professionals who work as consultant are often hired to find new avenues of solutions that internal personnel could not solve on their own and therefore tend to be more innovative problem-solving orientated. These conclusions lend construct validity to the new AI-W measure.

Table 6: Correlation Matrix

	B1	B2	B3	B4	B5	AI-W	AE	RG
B2	0.167							
	0.0001							
B3	0.193	0.467						
	0.0001	0.0001						
B4	0.192	0.242	0.407					
	0.0001	0.0001	0.0001					
B5	0.282	0.281	0.286	0.059				
	0.0001	0.0001	0.0001	0.1782				
AI-W	-0.161	0.0755	0.151	0.013	-0.317			
	0.0002	0.0865	0.0006	0.7642	0.0001			
AE	-0.111	0.086	0.264	0.076	-0.180	0.788		
	0.0116	0.0502	0.0001	0.1122	0.0001	0.0001		
RG	-0.119	0.121	0.137	-0.023	-0.218	0.821	0.548	
	0.0066	0.0058	0.0018	0.6067	0.0001	0.0001	0.0001	
SO	-0.140	-0.036	-0.544	-0.063	-0.333	0.671	0.268	0.329
	0.0015	0.4173	0.2166	0.1507	0.0001	0.0001	0.0001	0.0001

N = 517

B1 = Extraversion
B2 = Agreeableness
B3 = Conscientiousness
B4 = Neuroticism
B5 = Openness
AI-W = the average of total scores of the AI-W scale
AE = Approach to Efficiency
RG = Rule Governance
SO = Sufficiency of Originality

Table 7: Mean and Standard Deviation of AI-W Measures

	AI-W	AE	RG	SO
	Mean = 4.29	Mean = 3.75	Mean = 3.87	Mean = 5.26
	(Std = 1.24)	(Std = 1.60)	(Std = 1.65)	(Std = 1.59)
Gender				
Male (n = 264)	4.49 (1.19)	3.97	4.14 (1.64)	5.37 (1.56)
Female (n= 253)	4.09 (1.25)	3.52	3.59 (1.61)	5.15 (1.63)
	(p =0.0002)	(p = 0.0014)	(p = 0.0002)	(p = 0.1083)
Race				
African-American (n = 31)	3.90 (1.34)	3.20 (1.67)	4.14 (1.64)	5.34 (2.04)
American-Indian (n = 4)	6.03 (0.94)	5.58 (0.57)	5.75 (2.17)	6.75 (1.50)
Asian (n = 12)	3.77 (1.14)	3.11 (1.57)	3.52 (1.34)	4.67 (0.95)
Caucasian (n = 451)	4.30 (1.21)	3.77 (1.57)	3.91 (1.59)	5.36 (1.56)
Hispanic (n = 15)	4.90 (1.60)	4.27 (2.15)	4.20 (1.77)	6.22 (1.56)
Other (n = 7)	4.22 (0.87)	3.75 (1.22)	2.83 (1.55)	6.08 (1.86)
	(p = 0.0048)	(p = 0.0287)	(p = 0.0152)	(p = 0.0331)
Primary area of work				
Audit (n = 101)	4.10 (1.22)	3.73 (1.61)	3.69 (1.60)	4.87 (1.42)
Internal audit (n = 17)	5.01 (0.94)	4.29 (1.29)	4.21 (1.93)	6.51 (1.45)
Financial (n = 124)	4.26 (1.34)	3.59 (1.68)	3.93 (1.85)	5.24 (1.60)
Consulting (n = 25)	5.28 (1.37)	4.89 (2.08)	4.81 (1.80)	6.12 (1.69)
Tax (n = 112)	4.07 (1.12)	3.51 (1.42)	3.61 (1.55)	5.02 (1.55)
Managerial (n = 60)	4.52 (1.13)	4.03 (1.34)	4.01 (1.59)	5.50 (1.63)
Info system (n = 7)	5.33 (1.19)	4.95 (1.69)	5.14 (1.23)	5.90 (1.55)
Multiple areas (n = 56)	4.13 (1.14)	3.35 (1.50)	3.69 (1.28)	5.36 (1.65)
Other (n = 15)	4.39 (0.91)	3.68 (1.67)	4.13 (1.20)	5.35 (1.47)
	(p < 0.0001)	(p = 0.0007)	(p = 0.0148)	(p = 0.0003)

AI-W = the average of total scores of the AI-W scale
AE = Approach to Efficiency
RG = Rule Governance
SO = Sufficiency of Originality

Conclusion

The current paper introduces a new measure of adaption-innovation problem-solving style. In contrast to the previous KAI measure, our measure is much shorter and, more importantly, it is non-proprietary. Our study indicates that measures of reliability and convergent validity for the new AI-W measure are generally satisfactory. Discriminant validity is attained among factors of the AI-W and between the AI-W and Big-Five personality trait constructs. It should be noted that there is always a trade-off between the length of a scale and its reliability such that shorter measures often suffer a loss of reliability to some degree. Although the nine-item scale of the AI-W is considerably shorter than the 32 items of the KAI, its reliability does not appear to be significantly affected.[6]

[6] The study conducted by Bagozzi and Foxall (1996) shows the composite reliability on the KAI 32 item scale is between 0.61 and 0.87.

While the results in this study are quite strong and very consistent with the adaption-innovation theory upon which the AI-W is based, we urge some care in its use. In particular, the sample was selected from a single professional group of accountants within the U.S. and may not reflect every occupational group in the U.S. and elsewhere. This concern may be somewhat mitigated by two recent studies that use the seven-item AI-W scale to obtain data from paramedics. In these studies, McLeod, Clark, Warren, and Dietrich (2008) find learning differences in a work context between adaptors and innovators and McLeod and Wang (2009) find good reliability and strong support for the three-factor model. We note, however, that these studies still use subjects in the U.S. when applying the adaptive and innovative measure. Further research is needed to completely explore the new measure's properties by using subjects in some other countries and to generalize our findings to other contexts including a management accounting context.

Our study has practical implications regarding individual style or approach in management accounting environment. For example, adaptive management accountants may have different views regarding changes in existing procedures or different preferences in proposed initiatives. This could be important in situations when a firm experiences a decline in profit margin and faces changes to reverse the firm downward trend. The previous study shows that adaptive management accountants prefer less radical solutions while innovative management accountants tend to initiate more radical changes (Ensley et al 2006). But it is not clear, however, that such a difference in problem solving style among management accountants would help the firm develop more balanced strategic plans/solutions or would result in a possible conflict or problem among team members within the firm.

In addition, managerial accountants today face a dazzling number of innovations including target costing, lean accounting, introduction of alternative accounting standards such as IFRS, Activity Based Accounting, the proliferation of non-financial measures such as included in Balanced Scorecard systems, and internal accounting systems designed primarily to modify behavior rather than to develop accurate costs. These recent and new approaches come to a discipline that otherwise has remained static for a very long time. These changes suggest that problem solving may become more and more relevant to managerial accounting as the pace of change increases. Future research may examine how management accountants will respond to such changes and to develop appropriate coping mechanisms. We hope that this study will assist other researchers to pursue these issues.

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Appendix I - Adaption Innovation in the Workplace Measure (the AI-W Scale)

For each pair of statements circle the number that corresponds most closely with how you think about yourself when solving problems.

Approach to Efficiency										
I am disciplined, precise, and methodical in my approach to solving problems.	1	2	3	4	5	6	7	8	9	I am creative and like to approach tasks from unusual angles.
I can do routine work for long periods.	1	2	3	4	5	6	7	8	9	I avoid painstaking attention to detail.
I prefer to progress incrementally towards a defined goal.	1	2	3	4	5	6	7	8	9	I cannot tolerate following routines and structure all the time.
Rule Governance										
I perform best in situations where well-established rules exist.	1	2	3	4	5	6	7	8	9	I like to tackle situations where no rules exist.
I seek to solve problems with tried and accepted means.	1	2	3	4	5	6	7	8	9	I do not rely on accepted means to solve problems.
I value continuity, stability, consensus, and group unity.	1	2	3	4	5	6	7	8	9	I am not always reverent of consensus, custom, and group norms.
Sufficiency of Originality										
I am more concerned with resolving problems than finding them.	1	2	3	4	5	6	7	8	9	I like to identify problems and find new avenues of solution.
I like to produce few ideas, generally aimed at improving the existing system.	1	2	3	4	5	6	7	8	9	I like to produce numerous ideas, generally aimed at changing the existing system.
I prefer to present few solutions which I know will be feasible.	1	2	3	4	5	6	7	8	9	I like to propose many solutions, although some may turn out to be impractical.