# A Cross-Validation Study of the Kirton Adaption-Innovation Inventory in Three Research and Development Organizations

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A cross-validation study of the Kirton Adaption-Innovation Inventory (KAI) was conducted with 256 professional employees from three applied research and development organizations. The KAI was found to correlate well with direct measures of innovativeness (peer-nomination and management-rated measures of innovativeness) as well as with indirect indicators of innovativeness (number of publications, education, performance as rated by management, organizational level, self-esteem, intolerance of ambiguity, and need for clarity). These results, moreover, held up well in each of the three research and development organizations. The originality subscale was found to be a potentially useful short version of the KAI. Implications for the use of the KAI are discussed.

The Kirton Adaption-Innovation Inventory (KAI) was developed by Kirton (1976) to measure a basic personality dimension: a continuum which ranges from *adaption*, an ability to "do things better," to *innovation*, an ability to "do things differently." Kirton contends (1) that all individuals can be located on this continuum and (2) that adaption-innovation is an important personality dimension relevant to situations which involve organizational change. It is also logical to expect the adaption-innovation continuum to be useful in the study of creativity in organizational settings.

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Kirton (1976) developed, factor analyzed, and validated the 32-item KAI with other personality dimensions in a sample of 532 subjects from London and its vicinity who were heterogeneous with respect to occupational status, education, age, and sex. He found three factors which he labeled originality, efficiency, and rule/group conformity. These factors were scored so that innovators were higher than the mean and adaptors were lower than the mean. When scored in an innovative direction, these factors were negatively correlated with intolerance of ambiguity, inflexibility, and conservation but positively correlated with extraversion. These results are consistent with much of the prior research on creativity (Stein, 1968) and also with Maddi's (1976) notion that the creative or innovative person tends to be transcendent of social conventions in order to achieve fulfillment. According to Maddi's notion, the innovative person would tend to devalue social adjustment as a goal in life and the noncreative person would tend to be adaptive to social conventions in a conforming, unimaginative manner.

The objective of the present study was to examine the cross-validity of the KAI in three research and development organizations, using both direct measures and indirect indicators of innovativeness. Research and development organizations were selected for the study because their basic mission is the generation of in-

novations. Kirton (1976) validated the KAI with other personality traits, but he did not include any direct measures of innovativeness in his study. In addition, the correlations between the KAI and the other personality traits were not cross-validated by Kirton.

## Method

### Sites and Subjects

Professional employees of three applied research and development organizations located in the southwestern United States participated in the study. Organization A was the research and development laboratory of a large industrial corporation that specialized in the manufacture of capital equipment for the petroleum industry. A sample of 72 professional employees (94% response rate) was obtained. These employees had an average age of 38 years and an average time in their present position of 4 years. All the participants held a bachelor's degree, and many had graduate training.

Organization B was a division of a large governmental research and development organization. Organization B specialized in the development of computer software systems for aerospace projects. A sample of 91 professional employees (88% response rate) was obtained, with an average age of 40 years and an average time in present position of 5 years. Almost all the participants held a bachelor's degree, and many had graduate training.

Organization C was a division in the same large governmental research and development organization, specializing in the development of power and propulsion systems for aerospace vehicles. The sample from Organization C consisted of 93 professional employees (response rate of 92%), with an average age of 41 years and an average time in present position of 7 years. Almost all the participants held a bachelor's degree, and most had graduate training. The tasks of the three organizations represented a wide range of applied research and development activities.

Questionnaires were completed at each organization in subject groups of about 30 each.

### Measures

*The Kirton Adaption-Innovation Inventory* (Kirton, 1976) is a 32-item instrument with a 5-point scale which ranges from "very easy" to "very difficult." The subject is asked to imagine that he or she has been asked to present, consistently and for a long time, a certain image of himself or herself to others. The subject is then asked to rate the *difficulty* of presenting such an image for each of the traits or attributes stated in the items. The scale is scored so that innovators are higher than the mean and adaptors are lower than the mean.

*Innovativeness* was measured directly in two ways: by *peer nominations* (sociometric choice) and by *management ratings.* Each participant was asked to nominate up to four co-workers who had contributed most to important innovations in the respective organization. The number of nominations received by each individual became the innovativeness score for that person (Lindzey & Byrne, 1968; Stogdill & Shartle, 1955). In addition, management rank ordered the professional employees within their work unit on the basis of innovativeness. This innovativeness score was the rank order of the individual divided by the number of employees in the work unit.

*Performance* was measured by management ratings. The professional employees were rank ordered within their work unit by management on each of the five following performance criteria: quality of performance, quantity of performance, ability to get along with other employees, dependability, and total performance. The score on each criterion was the rank order divided by the number of employees in the work unit. A varimax factor analysis of the five performance criteria indicated that only one factor existed which was called overall performance. The reliability (coefficient alpha) of this overall performance measure in the present sample,

which consisted of the sum of the five performance criteria, was .93.

*Satisfaction* was measured by the Job Descriptive Index (JDI), which was developed and validated by Smith, Kendall, and Hulin (1969). The five subscales of the JDI (satisfaction with the work itself, supervision, pay, promotion opportunities, and co-workers) were summed to obtain an overall measure of job satisfaction. As suggested by Smith et al. (1969), a summation of the JDI scales can be useful in a multi-organizational project such as the present study. The JDI has been shown to have good reliability and validity across different samples (Smith et al., 1969; Smith, Smith, & Rollo, 1974; Gillet & Schwab, 1975). The coefficient alpha reliability of the overall satisfaction measure in the present sample was .87.

Four personality traits that have been related to innovativeness in prior research (Stein, 1968) were measured by the following scales, with alpha reliabilities for the present sample given in parentheses:

*Need for clarity* (.82) was measured by the 6 item instrument developed by Ivancevich and Donnelly (1974). This instrument taps the need for clarity that an individual has in his or her job.

The 16-item *intolerance of ambiguity* scale (.64), developed and validated by Budner (1962), was used to measure the basic lack of tolerance for ambiguity that an individual has in general—not necessarily related to the individual's job.

*Self-esteem* (.86) was measured by the 10-item Rosenberg (1965) scale.

*Locus of control* (.81) was measured by the 23-item scale developed by Rotter (1966). A high locus of control score indicated an external control whereby the person believes that reinforcements are not under his or her control but rather under the control of powerful others, luck, or fate. A low score indicated an internal control whereby a person believes that he or she can control reinforcements through his or her own behaviors, capacities, or attributes.

Four demographic variables were also measured: *age, education,* the *organizational level* of one's position, and number of *publications* authored.

## Results

Table 1 reports the factor loadings and communalities from a two-factor solution to a varimax factor analysis of the KAI (SPSS version 6.01, type PA2, in Nie, Hull, Jenkins, Steinbrenner, & Bent, 1975). For the present sample, the first factor of "originality" (eigenvalue of 6.83) was similar to that found in Kirton's (1976) sample. Kirton's other two factors of "efficiency" and "rule/group conformity," however, collapsed into one factor called "efficiency and conformity" (eigenvalue of 4.02) in the present sample. (The next three eigenvalues were 1.74, 1.57, and 1.40, respectively. The eigenvalues were the sum of the squared factor loadings based on a factor analysis of the correlation matrix with communality estimates in the diagonal.)

For comparison with Kirton's (1976) results, scores were computed for the two subscales—originality, and efficiency and conformity—that were formed from the factor analysis of the data from the present sample and also for the 32-item KAI total scale. Means, standard deviations, neutral scores, and reliabilities for these scales are presented in Table 2.

The means of all the scales were in the innovative direction from the neutral point, but the differences were not statistically significant. (Kirton's, 1976, mean was almost at the neutral point with his heterogeneous sample.) These results are not surprising, since the professional employees of research and development organizations would be expected to be oriented toward innovativeness. The reliabilities were adequate and about the same as those reported by Kirton (1976). The KAI total scale correlated .88

Table 1
Item Factor Loadings of the Kirton Adaption-Innovation Inventory (KAI)
(N = 256)

| Item | Factor: Originality | Factor: Efficiency and conformity | Communality |
|---|---|---|---|
| Has original ideas | -.74 | .05 | .54 |
| Proliferates ideas | -.62 | .02 | .38 |
| Is stimulating | -.60 | .23 | .42 |
| Can stand out in disagreement against group | -.62 | -.03 | .38 |
| Prefers colleagues who never "rock the boat" | .50 | -.25 | .31 |
| Copes with several new ideas at the same time | -.62 | .12 | .40 |
| Will always think of something when stuck | -.58 | .05 | .34 |
| Would sooner create than improve | -.45 | .07 | .21 |
| Has fresh perspectives on old problems | -.68 | .14 | .48 |
| Likes the protection of precise instructions | .57 | -.28 | .40 |
| Prefers changes to occur gradually | .48 | -.23 | .28 |
| Often risks doing things differently | -.59 | -.05 | .35 |
| Prefers to work on one problem at a time | .41 | -.15 | .19 |
| Enjoys detailed work | .04 | -.44 | .20 |
| Is prudent when dealing with authority | .11 | -.37 | .15 |
| Likes bosses and work patterns which are consistent | .14 | -.49 | .26 |
| Works without deviation in a prescribed way | .27 | -.54 | .36 |
| Is consistent | .01 | -.47 | .22 |
| Is predictable | .19 | -.42 | .21 |
| Masters all details painstakingly | .18 | -.49 | .27 |
| Imposes strict order on matters within own control | .05 | -.50 | .26 |

(Continued on next page)

Table 1 (Continued)
Item Factor Loadings of the Kirton Adaption-Innovation Inventory (KAI)

| | Factor | | |
|---|---|---|---|
| | Originality | Efficiency and conformity | Communality |
| Fits readily into "the system" | .26 | -.44 | .26 |
| Is thorough | .16 | -.54 | .32 |
| Is methodical and systematic | .10 | -.61 | .39 |
| Is a steady plodder | .25 | -.45 | .27 |
| Holds back ideas until obviously needed | .29 | -.22 | .14 |
| Needs the stimulation of frequent change | -.26 | .10 | .08 |
| Conforms | .41 | -.47 | .39 |
| Readily agrees with the team at work | .35 | -.38 | .27 |
| Never seeks to bend or break the rules | .45 | -.41 | .37 |
| Never acts without proper authority | .42 | -.40 | .33 |
| Likes to vary set routines at a moment's notice | -.27 | .06 | .08 |

Note: Underlining indicates inclusion of an item in the above factor.

($p<.001$) with the originality subscale and -.58 ($p< .001$) with the efficiency and conformity subscale. The two subscales had a correlation of -.29 ($p<.001$).

Correlations between the KAI total scale and subscales and the other variables measured are reported for the total sample in Table 3. These results indicate that the KAI total scale has good validity for a number of the direct measures and indirect indicators of innovativeness. The KAI total scale correlated well with both direct measures of innovativeness—peer-nominations and management-ratings. In addition, number of publications, education, the organizational level of one's position, and performance (management ratings) all were correlated with the KAI total scale.

Other personality variables also showed correlations that indicate validity for the KAI total score. Both intolerance of ambiguity and need for clarity had negative correlations with the KAI total score, while self-esteem had positive correlations with the scale. The KAI total score was also unrelated to job satisfaction, which would suggest that the scale is relatively free of a halo effect from a favorable attitude toward the job. In addition, the scale was not significantly correlated with either age or an external locus of control.

The correlations with the criterion variables for the originality subscale were almost the same as those for the KAI total scale. The efficiency and conformity subscale also had correlations with the criterion variables that were similar to those for the KAI total scale, except for a lack of a significant correlation with self-esteem.

Data for each of the three research and development organizations were also analyzed sep-

Table 2
Descriptive Statistics of the Kirton Adaption-Innovation Inventory (KAI) for the KAI Total Scale and Sub-Scales
(N = 256)

| Statistic | KAI total scale | KAI sub-scales: Originality | KAI sub-scales: Efficiency and conformity |
|---|---|---|---|
| Mean | 100.92 | 45.18 | 32.91 |
| Standard deviation | 14.26 | 7.69 | 6.10 |
| Neutral score | 96.00 | 39.00 | 36.00 |
| Reliability (Coefficient Alpha) | .88 | .86 | .80 |

arately, and those correlations between the KAI total scale and the criterion variables are reported in Table 4. These results show that the KAI total scale held up rather well in each of the three organizations, which indicates that the scale demonstrated cross-validity. These similar results in each of the three organizations are especially encouraging, since the organizations

Table 3
Correlates of the Kirton Adaption-Innovation Inventory (KAI) for the KAI Total Scale and Sub-Scales
(N = 256)

| Variable | KAI total scale | KAI sub-scales: Originality | KAI sub-scales: Efficiency and conformity |
|---|---|---|---|
| Innovativeness (peer nominations) | .40*** | .37*** | -.28*** |
| Innovativeness (management ratings) | .40*** | .39*** | -.20*** |
| Publications | .22*** | .13* | -.16** |
| Education | .34*** | .33*** | -.13* |
| Age | .05 | .06 | -.08 |
| Organizational level | .27*** | .26*** | -.27*** |
| Performance | .25*** | .26*** | -.15** |
| Satisfaction | .01 | .06 | -.05 |
| Intolerance of ambiguity | -.44*** | -.40*** | .27*** |
| Need for clarity | -.36*** | -.33*** | .37*** |
| Self-esteem | .27*** | .37*** | -.04 |
| Locus of control (external) | -.06 | -.12 | .01 |

Note: All tests are two-tailed.
* p < .05; ** p < .01; *** p < .001

represent a rather wide range of applied research and development activities and environments.

## Discussion

The results of this study indicate that the KAI is a reliable and valid measure of an innovative orientation among applied research and development professional personnel. The present study's results for peer-nomination and management-rated innovativeness, and the demographic criteria of number of authored publications and education, extend the validity of the KAI to other than self-perceived criteria. The KAI also correlated well with management-rated performance and the organizational level of one's position. Given the innovative mission of a research and development organization, these results also suggest that the KAI is a measure of an innovative orientation. The results regarding the personality traits are consistent with those of Kirton (1976) with a heterogeneous sample from the London area. The lack of a significant correlation with job satisfaction suggests that the KAI also is relatively free of a halo effect from a favorable attitude toward the job.

The results of Kirton (1976) and the present study indicate that the KAI may be a useful measure of an individual's innovative orientation. Such a measure could be useful in a number of applied or research settings: (1) predicting/diagnosing important factors in an organizational change project; (2) describing decision-making and problem-solving styles; and (3) predicting employee "fit" in innovative tasks, such as those found in a research and development organization. The diversity of the samples used in these two studies, moreover, suggests that the KAI may be used in a variety of English-speaking cultures.

The results of the present study also indicate that the 13-item originality subscale may be a useful short version of the KAI. The originality

Table 4
Correlates of the Kirton Adaptation-Innovation Inventory (KAI) Total Scale for Each Organization

| Variable | Organization A (N = 72) | Organization B (N = 91) | Organization C (N = 93) |
|---|---|---|---|
| Innovativeness (peer nominations) | .40*** | .42*** | .41*** |
| Innovativeness (management ratings) | .42*** | .45*** | .33*** |
| Publications | .62*** | .23* | .15 |
| Education | .30** | .34*** | .21* |
| Age | .12 | -.03 | .05 |
| Organizational level | .25* | .38*** | .21* |
| Performance | .30** | .32** | .14 |
| Satisfaction | .21 | -.04 | .00 |
| Intolerance of ambiguity | -.37*** | -.39*** | -.50*** |
| Need for clarity | -.43*** | -.31** | -.38*** |
| Self-esteem | .05 | .30** | .28** |
| Locus of control (external) | -.14 | -.16 | .06 |

Note: All tests are two-tailed.
* $p < .05$; ** $p < .01$; *** $p < .001$

subscale correlated .88 with the total KAI scale and had very similar reliability and validity results to those of the KAI total scale.

Since the KAI has been developed only recently, and since only a relatively small amount of validation evidence exists for it, additional research is clearly needed to corroborate the results of Kirton (1976) and the present study. It would be especially interesting to see if the KAI could predict the acceptance of an organizational change effort in a work organization or the choice of problem-solving styles in a laboratory setting.

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