MINT~RC

MANAGEMENT OF INNOVATION AND NEW TECHNOLOGY RESEARCH CENTRE

IMPROVING THE PSYCHOMETRIC PROPERTIES OF THE BASADUR SIMPLEX CREATIVE PROBLEM SOLVING PROFILE INVENTORY

by

Min Basadur

Management of Innovation and New Technology Research Centre

WORKING PAPER NO. 84
1998

McMASTER
• UNIVERSITY •

MICHAEL G. DeGROOTE
SCHOOL OF BUSINESS

Innis
[redacted]
HD
45
.W657
no.84

IMPROVING THE PSYCHOMETRIC PROPERTIES OF THE BASADUR SIMPLEX CREATIVE PROBLEM SOLVING PROFILE INVENTORY

by

Min Basadur

Management of Innovation and New Technology
Research Centre

WORKING PAPER NO. 84
1998

The Working Paper series is intended as a means whereby a researcher may communicate his or her thoughts and findings to interested readers for their comments. The paper should be considered preliminary in nature and may require substantial revision. Accordingly, this Working Paper should not be quoted nor the data referred to without the written consent of the author. Your comments and suggestions are welcome and should be directed to the author.

McMASTER UNIVERSITY LIBRARY

IMPROVING THE PSYCHOMETRIC PROPERTIES OF THE BASADUR SIMPLEX CREATIVE PROBLEM SOLVING PROFILE INVENTORY

ABSTRACT

Follow-on research was conducted to improve the psychometric properties of the Basadur Simplex Creative Problem Solving Profile (CPSP) Inventory. How the inventory was originally developed and tested for reliability and validity is reviewed. Then, a special stepwise procedure that was used to improve the inventory is described. First, the inventory was expanded from twelve to twenty-one item groups. This improved internal consistency significantly. Then selected word pairs were systematically removed from the two bi-polar scales of the expanded inventory to try to reduce the number of item groups while maintaining the internal consistency improvement. A new twelve item group experimental version emerged and was recommended for further testing. The twenty-one item group expanded scale was the best alternative overall psychometrically and was also recommended for further testing. Additional opportunities were identified for further improving both the new twenty-one and twelve item group experimental inventories.

IMPROVING THE PSYCHOMETRIC PROPERTIES OF THE BASADUR SIMPLEX CREATIVE PROBLEM SOLVING PROFILE INVENTORY

INTRODUCTION AND BACKGROUND

The development and reliability and validity testing of the Basadur Simplex Creative Problem Solving Profile (CPSP) Inventory (Figure 1) was described by Basadur (1998) and Basadur, Graen and Wakabayashi (1990). The purpose of this paper is to report follow-on research to improve the psychometric properties of the instrument.

Briefly, the CPSP is founded on two principles. The first is the basic complete process approach to understanding creativity. That is, that creativity is a function of knowledge, imagination and judgment. The second is the concept of learning and creating as a circular continuous flow. The inventory suggests that people acquire and use knowledge differently. Two opposite ways that people learn or acquire knowledge are through experience (becoming personally involved in a task) and through thought (observing, analyzing and theorizing). Similarly, two opposing ways in which knowledge can be used are for ideation (generating options, ideas and points of view while deferring judgment) and for evaluation (judging and selecting from among those options, ideas and points of view). Figure 2 illustrates these two dimensions and their opposite poles.

The four columns of words in Figure 1 represent these two opposing ways of acquiring or gaining knowledge (by experiencing – column 1, or X; and by thinking – column 3, or T) and two opposing ways of using knowledge (for ideation – column 2, or I; and for evaluation – column 4, or E). By plotting one's column scores on a two dimensional graph (Figure 3), one can display a preferred blend of four different creative problem solving

Figure 1

Creative Problem Solving Profile Inventory

This inventory is designed to describe your method of problem solving. Give a high rank to those words which best characterize the way you problem solve and a low rank to the words which are least characteristic of your problem solving style.

You may find it hard to choose the words that best describe your problem solving style because there are no right or wrong answers. Different characteristics described in the inventory are equally good. The aim of the inventory is to describe how you solve problems, not to evaluate your problem solving ability.

Instructions:

Eighteen sets of four words are listed horizontally below. In each horizontal set assign a 4 to the word which best characterizes your problem solving style, a 3 to the word which next best characterizes your problem solving style, a 2 to the next most characteristic word, and a 1 to the word which is least characteristic of you as a problem solver. Be sure to assign a different number to each of the four words in each horizontal set. Do not make ties.

	Column 1	Column 2	Column 3	Column 4
1	_____ Alert	_____ Poised	_____ Ready	_____ Eager
2	_____ Patient	_____ Diligent	_____ Forceful	_____ Prepared
3	_____ Doing	_____ Intuitive	_____ Detached	_____ Selective
4	_____ Experiencing	_____ Optimistic	_____ Objective	_____ Verifying
5	_____ Reserved	_____ Serious	_____ Fun-loving	_____ Playful
6	_____ Sensing	_____ Free Thinking	_____ Logical	_____ Experimenting
7	_____ Feeling	_____ Alternatives	_____ Analyzing	_____ Evaluating
8	_____ Action	_____ Divergence	_____ Abstract	_____ Convergence
9	_____ Direct	_____ Possibilities	_____ Conceptual	_____ Practicalities
10	_____ Quiet	_____ Trustworthy	_____ Irresponsible	_____ Imaginative
11	_____ Involved	_____ Proliferating	_____ Theoretical	_____ Testing
12	_____ Probing	_____ Projecting	_____ Structuring	_____ Examining
13	_____ Immediate	_____ Gathering	_____ Understanding	_____ Confirming
14	_____ Impersonal	_____ Proud	_____ Hopeful	_____ Fearful
15	_____ Implementing	_____ Visualizing	_____ Modelling	_____ Decisive
16	_____ Present-oriented	_____ Future-oriented	_____ Rational	_____ Detail-oriented
17	_____ Sympathetic	_____ Pragmatic	_____ Emotional	_____ Procrastinating
18	_____ Aware	_____ Childlike	_____ Orderly	_____ Realistic

Figure 2

Differences in Gaining and Using Knowledge that Cause Differences in Creative Process Profiles

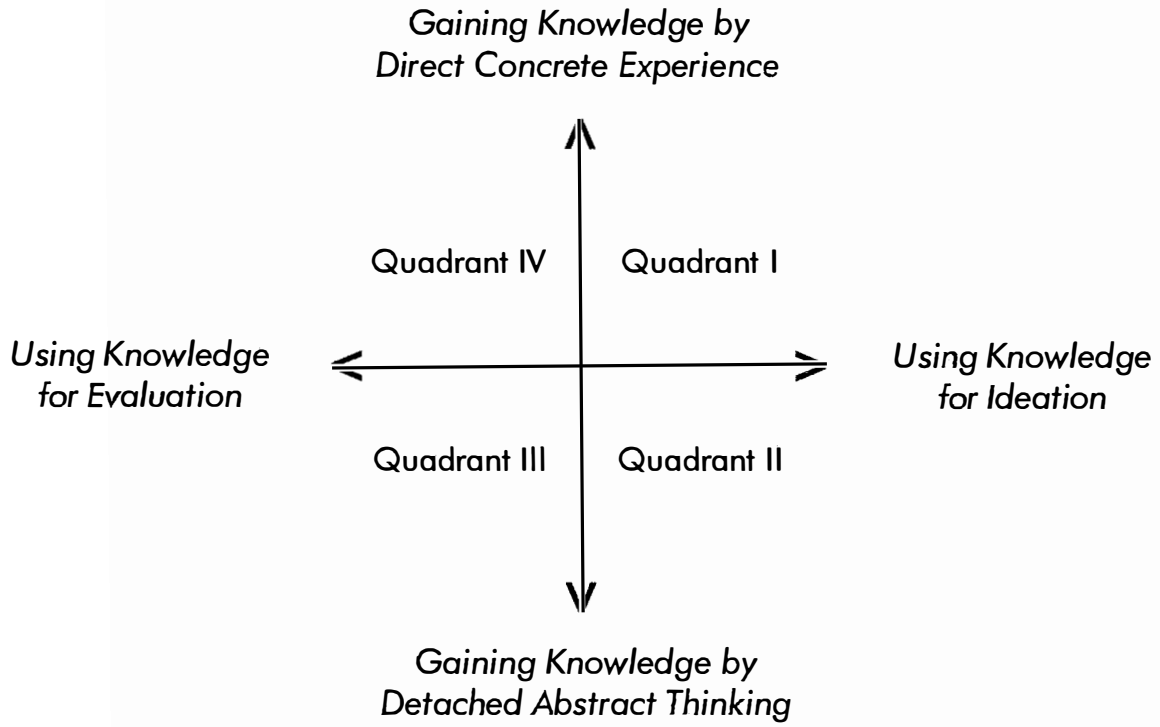


Figure 3

Creative Process Profile

SCORING: In each Column, add up all the items except 1, 2, 5, 10, 14 and 17, to get your column scores.

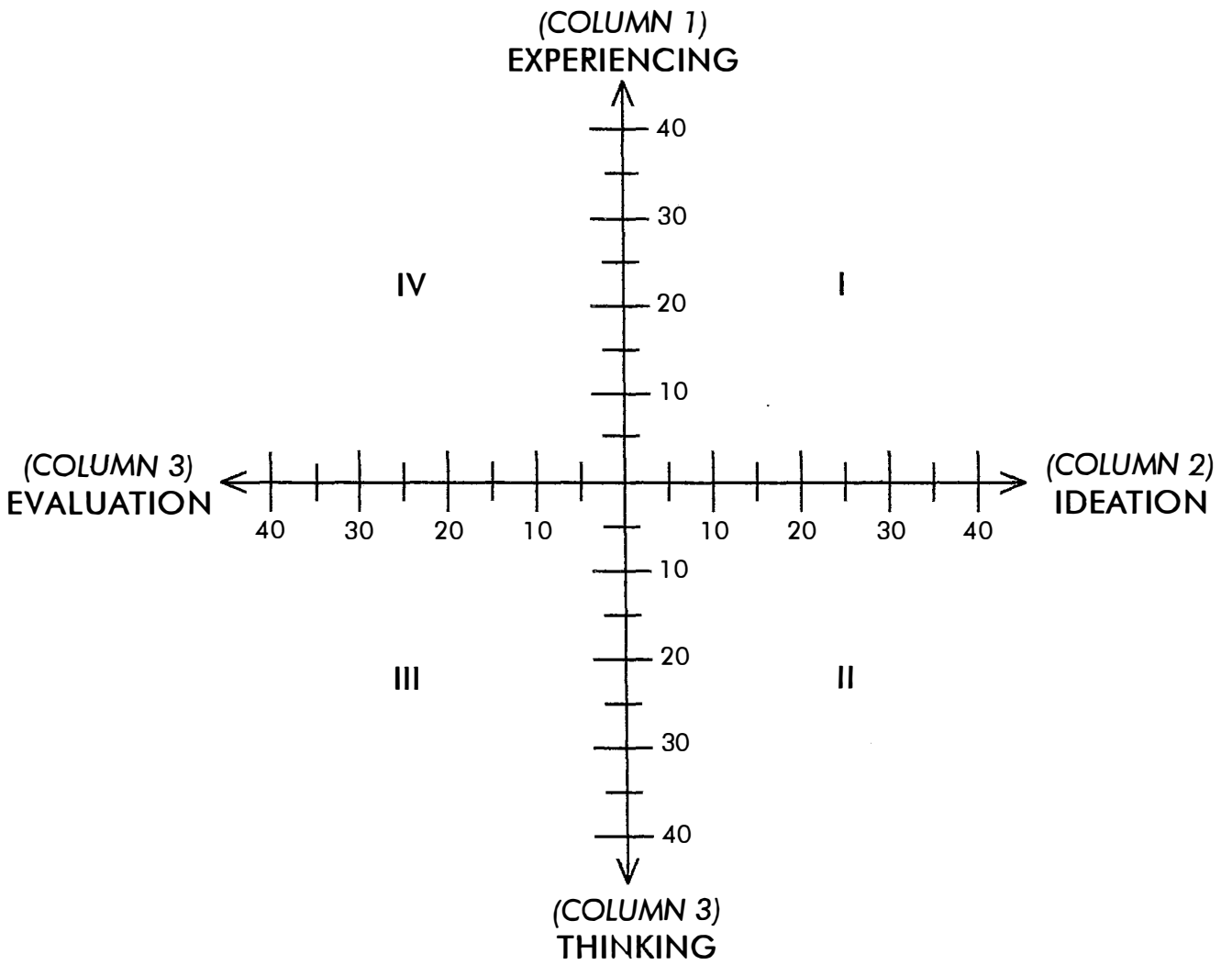
LEGEND: Column 1 scores indicate the orientation to getting knowledge by Experiencing. (Direct personal involvement.)

Column 2 scores indicate the orientation to using knowledge by Ideation. (The generation of ideas without judgment.)

Column 3 scores indicate the orientation toward getting knowledge by Thinking. (Detached abstract theorizing.)

Column 4 scores indicate the orientation toward using knowledge for Evaluation. (The application of judgment to ideas.)

Post your total scores for each column on the appropriate axis below.



To develop your personal creative process profile, simply connect the 4 points in sequence with 4 curved lines to make a distorted or "warped" circle accordingly. (If you have identical column scores, you will have a perfect circle. This is unlikely.) The quadrant in which your profile is most dominant indicates your strongest orientation. The other quadrants represent secondary styles accordingly. Your profile is your own unique blend of the four quadrants.

styles. The styles are defined by the columns taken in pairs – four different combinations (X, I; I, T; T, E; and E, I) creating four quadrants. One's largest quadrant is one's preferred style. One's unique blend of styles is one's profile.

An individual's unique profile (CPSP) portrays the individual's blend of relative preferences for these opposing ways of gaining knowledge (experiencing versus thinking) and of using knowledge (ideation versus evaluation). It explains people's varying orientations toward aspects of the innovation process and suggests how to combine those orientations for effective and creative teamwork. In order to better understand these orientations and to determine their own preferences, individuals can complete the inventory, as shown in Figure 1. Then they calculate scores to plot their unique creative problem solving profiles using the graph shown in Figure 3.

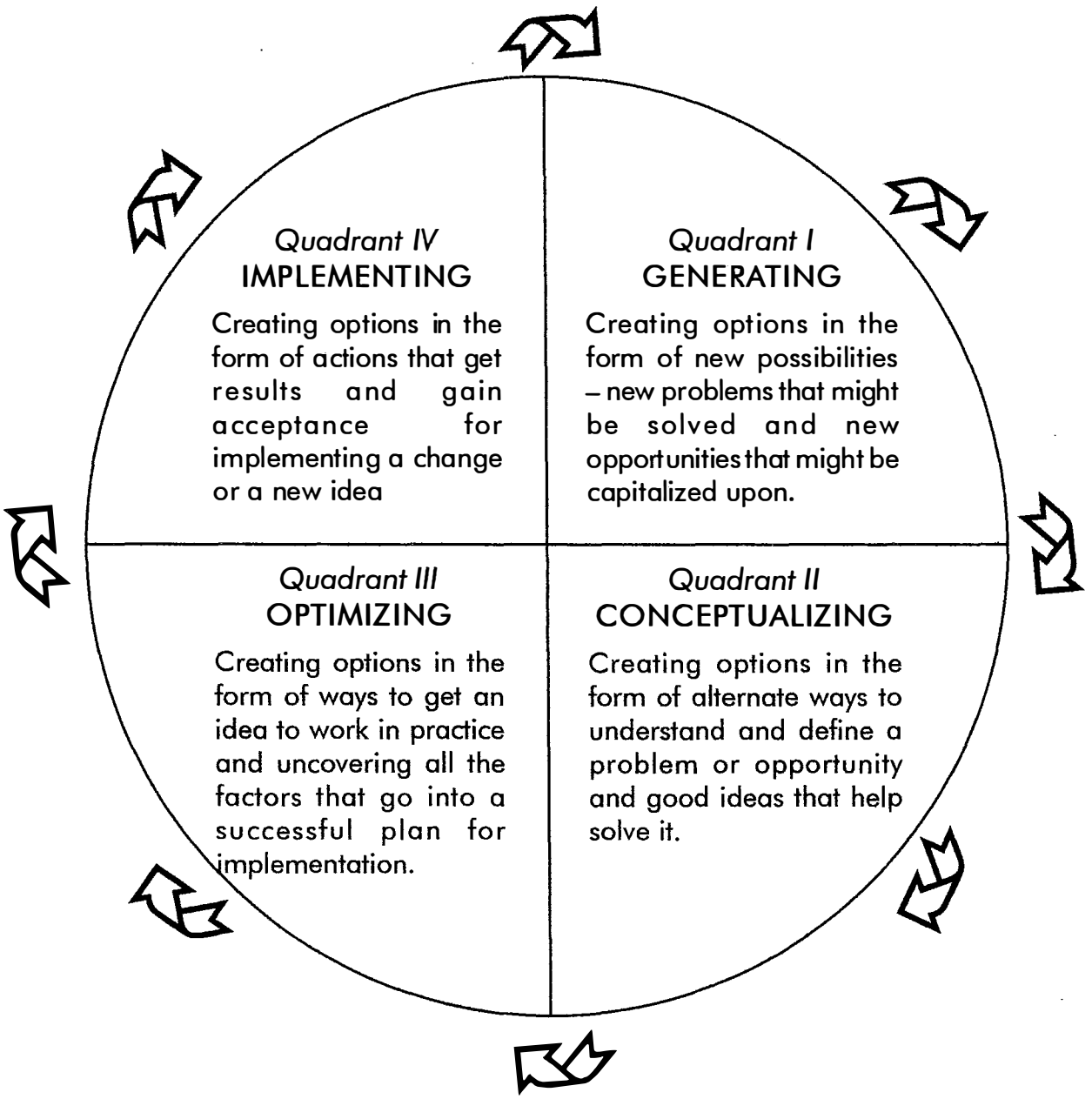
Creative problem solving or innovation can be considered as a continuous process in the form of a spinning wheel called Simplex. The process has four quadrants or stages: generation, conceptualization, optimization, and implementation. These stages of the process are shown in Figure 4 and are briefly reviewed below. A more complete description is provided in the Appendix.

1. Generating

Individuals who prefer generating tend to gain knowledge through direct experience and to use it to create options, or diverge, rather than evaluate options, or converge. A generator creates options in the form of new possibilities – new problems that might be solved and new opportunities that might be capitalized upon.

Figure 4

The Four Stages of the Creative Process



II. Conceptualizing

Conceptualizing also involves divergence. But rather than gain knowledge by direct experience, individuals who favor conceptualizing tend to gain knowledge by detached, abstract thinking. A conceptualizer creates options in the form of alternate ways to understand and define a problem or opportunity and good ideas that help solve it.

III. Optimizing

Optimizing is the opposite of generating. Optimizers prefer to gain knowledge through detached, abstract thinking and to use it to converge, thus converting abstract ideas and alternatives into practical solutions and plans. An optimizer creates options in the form of ways to get an idea to work in practice and uncovering all the factors that go into a successful plan for implementation.

IV. Implementing

Implementing is the opposite of conceptualizing. Implementers prefer to gain knowledge by direct experience rather than by detached, abstract thinking, and to use knowledge to converge. An implementer creates options in the form of actions that get results and gain acceptance for implementing a change or a new idea.

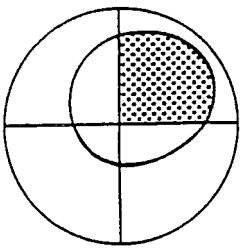
An individual's process profile will likely be skewed toward particular quadrants to reflect the individual's peculiar blend. The largest of the four quadrants indicates their

strongest orientation. The others represent supporting orientations in turn. Figure 5 shows how individual differences in orientation can yield different creative process profiles. For example, if the area of the profile in quadrant 1 is larger than in the other three, the primary creative process style is generating; if quadrant 2, then conceptualizing; if quadrant 3, then optimizing; and if quadrant 4, then implementing. Each of these styles reflects individual ways of gaining and using knowledge.

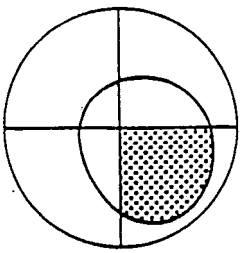
In order to succeed in innovation, a team or organization requires strengths in all four quadrants. Members must learn to use their differing styles in complementary ways. For example, generating ideas for new products and methods must start somewhere, with some individuals scanning the environment, picking up data and cues from customers, and suggesting possible opportunities for change and improvement. Thus, generators raise new information and possibilities – usually not fully developed but in the form of starting points for new projects. Then conceptualizers pull together the facts and idea fragments from the generator stage into well-defined challenges and opportunities and more clearly developed ideas worth further evaluation. Good conceptualizers give sound structure to fledgling ideas and opportunities. Optimizers then take these well-defined challenges and ideas, and find a practical best solution and well-detailed, efficient plan for proceeding. Finally, implementers must carry forward the practical solutions and plans to completion. This includes convincing colleagues or customers of the worth of the changes, and adapting the solutions and plans to make them fit real-life situations and conditions. Skills in all four quadrants are equally valuable. Organizations and teams must appreciate the importance

Figure 5

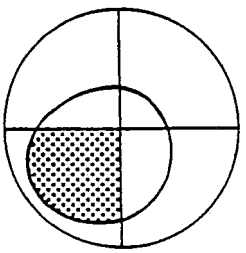
Creative Process Profiles with Different Dominant Styles



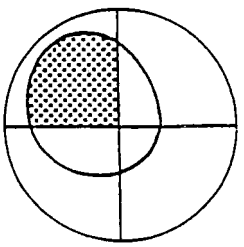
Generator style dominant with all three other styles relatively small.



Conceptualizer style dominant with all three other styles relatively small.



Optimizer style dominant with all three other styles relatively small.



Implementer style dominant with all three other styles relatively small

of all four quadrants and find ways to integrate and reward performance in all of these styles.

REVIEW OF PSYCHOMETRIC TESTING TO DATE

Basadur (1998) described how the appropriateness of the items in Figure 1 was confirmed. First, using a non-ipsative version of the inventory, Cronbach alphas and inter-item correlations were calculated on two samples (n=149; 107) to test internal consistency of the four columns (X, I, T, E) and the two bi-polar scales (X-T and I-E). This was followed by reliability studies of the regular, ipsative version. The reliability studies included test-retest correlations on the columns and bi-polar scales using two samples (n=129; 40); parallel split half Spearman-Brown corrected reliability estimates on the four quadrants using five samples (n=156; 129; 101; 137; 1639); and inter-correlations of quadrants, columns and bi-polar scales using the same five samples. The validity studies included various tests of external and predictive validity. These included correlations with already established measures relating to creativity including the Kirton Adaptation-Innovation Inventory (Kirton, 1976; 1987) and the Myers-Briggs Type Indicator (Myers, 1962); comparison of expected style preferences by occupation or field of endeavor with actual scores; and customized predictive validity experiments.

Both the reliability and validity data provided evidence of adequate reliability and validity of the inventory. However, several opportunities for improvement were identified especially in the reliability and internal consistency data (Basadur 1998). These opportunities were supported by field experience. Sometimes respondents reported that

while they were qualitatively accurate, their calculated profiles were not as sharply skewed (weighted) toward one or two dominant styles (quadrants) as their own self-perceptions suggested. This phenomenon would be consistent with some scale items being "dead weight" (correlating weakly or even negatively with the rest of the items in the column) and there were data supporting this explanation. For example, using the non-ipsative format, correlations of some of the bi-polar scale item pairings with the rest of the item pairs in the same scale were inconsistent across samples. In one sample, (n=149), item pair 15 (implementing-modeling) in the X-T bi-polar scale correlated quite strongly (.30) with the rest of the X-T scale item pairs; but in the other sample, (n=107), the same correlation was very weak (.08). In addition, the correlations for item pair 18 (aware-orderly) were quite weak in both samples, and in one of the samples, the Cronbach Alpha for the X-T scale was below .70, which serves as an informal benchmark.

METHOD

It was decided to embark on a program to improve these psychometric characteristics by focusing on improving the bi-polar scales, X-T and I-E. The inventory is based on these two dimensions of opposing concepts and the two scales had demonstrated excellent independence of each other and satisfactory internal consistency. The strategy was to try to increase the internal consistency of the two bi-polar scales and expect that corresponding improvements to the four columns and quadrants would follow. It was also decided to monitor the effects of any reliability improvements on the independence of the bi-polar scales and inventory validity.

Following the approach used by Basadur (1998) in the development and testing of the instrument, we began to experiment with the non-ipsative format first. Bi-polar scale item pairings were changed to try to improve internal reliability. Using the n=149 sample, we tried a number of different combinations and deletions and could make only slight improvements in either the Cronbach alpha or the correlation between the new combination and the rest of the bi-polar scale items taken as a group. However, as we investigated the effects of various pairings of words on the scales by their presence or absence, we began to improve our understanding of the X-T scale and what it was measuring.

It seemed that the construct "gaining knowledge" might be slightly better labeled as "gaining understanding". Perhaps X-T is more accurately measuring "gaining understanding" in two opposing ways. For example, the word "logical" (in column 3) seemed to represent perhaps more of a way of processing information to increase understanding rather than to gain knowledge. It represents more of a mental processing of information than a gaining of knowledge. Perhaps there is a continuum of gaining information to gaining knowledge to gaining understanding. The same might be true for the word "rational". Perhaps what the X-T dimension was intended to do was to differentiate and measure gaining understanding either by "hands on experience" or by "thinking about it". We decided that perhaps the scale was likely better understood as gaining understanding by physical processing vs. gaining understanding by mental processing. We concluded that this (perhaps) small difference was nevertheless a valuable one to guide our work. (This line of thinking, coincidentally, is popular with some researchers in the field of

"knowledge management" who suggest a progression from information to knowledge to understanding on a continuum.)

We then considered all the words in columns 1 and 3. We identified those words in columns 1 and 3 that most and least clearly fit with gaining understanding to cement our own understanding of the concept. Then we added to each of the X and T columns new words that seemed to fit with gaining understanding. We extended this work to the I and E columns. In other words, we generated some additional words for the four columns which as clearly as possible (in our opinion) represent the concepts of gaining understanding by either physical processing (doing) or by mental processing (thinking) and using that understanding either for ideation (creating options) or for evaluation (deciding among options).

Expanded 21 Item Experimental Inventory

From the additional potential new words for each column that were generated, the best nine pairings (X-T) and (I-E) were selected on judgment and added to the original 12 item pairs of Figure 1. This produced a new expanded experimental 21 item inventory. The six distractors were retained and the nine new items simply added to the original 18 (including distractors) to make 27 in total. This expanded inventory was set up in both the ipsative and non-ipsative formats. The two formats are shown in Figures 6 and 7. The coding system used for the items in the expanded inventory for the psychometric analyses in the following tables is shown in Figure 8.

Figure 6

Expanded Experimental Inventory (Ipsative Version)

This inventory is designed to describe your method of problem solving. Give a high rank to those words which best characterize the way you problem solve and a low rank to the words which are least characteristic of your problem solving style.

You may find it hard to choose the words that best describe your problem solving style because there are no right or wrong answers. Different characteristics described in the inventory are equally good. The aim of the inventory is to **describe how** you solve problems, **not to evaluate** your problem solving ability.

Instructions:

Twenty-seven sets of four words are listed horizontally below. In each horizontal set assign a four (4) to the word which best characterizes your problem solving style, a three (3) to the word which next best characterizes your problem solving style, a two (2) to the next most characteristic word, and a one (1) to the word which is least characteristic of you as a problem solver. Be sure to assign a different number to each of the four words in each horizontal set. Do not make ties.

	Column 1	Column 2	Column 3	Column 4
1.	_____ Alert	_____ Poised	_____ Ready	_____ Eager
2.	_____ Patient	_____ Diligent	_____ Forceful	_____ Prepared
3.	_____ Doing	_____ Intuitive	_____ Detached	_____ Selective
4.	_____ Experiencing	_____ Optimistic	_____ Objective	_____ Verifying
5.	_____ Reserved	_____ Serious	_____ Fun-loving	_____ Playful
6.	_____ Sensing	_____ Free Thinking	_____ Logical	_____ Experimenting
7.	_____ Feeling	_____ Alternatives	_____ Analyzing	_____ Evaluating
8.	_____ Action	_____ Divergence	_____ Abstract	_____ Convergence
9.	_____ Direct	_____ Possibilities	_____ Conceptual	_____ Practicalities
10.	_____ Quiet	_____ Trustworthy	_____ Irresponsible	_____ Imaginative
11.	_____ Involved	_____ Proliferating	_____ Theoretical	_____ Testing
12.	_____ Probing	_____ Projecting	_____ Structuring	_____ Examining
13.	_____ Immediate	_____ Gathering	_____ Understanding	_____ Confirming
14.	_____ Impersonal	_____ Proud	_____ Hopeful	_____ Fearful
15.	_____ Implementing	_____ Visualizing	_____ Modelling	_____ Decisive
16.	_____ Present-oriented	_____ Future-oriented	_____ Rational	_____ Detail-oriented
17.	_____ Sympathetic	_____ Pragmatic	_____ Emotional	_____ Procrastinating
18.	_____ Aware	_____ Childlike	_____ Orderly	_____ Realistic
19.	_____ Physical	_____ Guessing	_____ Thinking	_____ Focusing
20.	_____ Trial & Error	_____ Approximately	_____ Pondering	_____ Pinning Down
21.	_____ Concrete	_____ Creating Options	_____ Book Learning	_____ Deciding
22.	_____ Hands on	_____ Staying Open	_____ Reading	_____ Closing
23.	_____ Practice	_____ Transforming	_____ Synthesizing	_____ Choosing
24.	_____ Manipulate	_____ Changing Perspectives	_____ Integrating	_____ Narrowing
25.	_____ Handle	_____ Speculating	_____ Fathoming	_____ Judging
26.	_____ Poking Around	_____ Diversifying	_____ Distilling	_____ Eliminating
27.	_____ Contact	_____ Novelizing	_____ Impersonal	_____ Making Sure

Expanded Experimental Inventory (Non-Ipsative Versions)

This inventory is designed to describe your method of problem solving. Give a high rank to those words which best characterize the way you problem solve and a low rank to the words which are least characteristic of your problem solving style.

You may find it hard to choose the words that best describe your problem solving style because there are no right or wrong answers. Different characteristics described in the inventory are equally good. The aim of the inventory is to **describe how** you solve problems, **not to evaluate** your problem solving ability.

Instructions:

1	2	3	4	5
Very little Characteristic of my Problem Solving Style	A little bit Characteristic of my Problem Solving Style	Somewhat Characteristic of my Problem Solving Style	Quite Characteristic of my Problem Solving Style	Very Much Characteristic of my Problem Solving Style

For each of the 108 words below, assign a number from 1 to 5 indicating to what extent you feel it characterizes your style of solving problems. If the word is very characteristic of your problem solving style, give it a higher score say four or five. If the word is very little characteristic of your problem solving style, give it a lower score, say one or two. Consider each horizontal set of four words as a group before going on to the next horizontal set of four words.

_____ Alert	_____ Poised	_____ Ready	_____ Eager
_____ Patient	_____ Diligent	_____ Forceful	_____ Prepared
_____ Doing	_____ Intuitive	_____ Detached	_____ Selective
_____ Experiencing	_____ Optimistic	_____ Objective	_____ Verifying
_____ Reserved	_____ Serious	_____ Fun-loving	_____ Playful
_____ Sensing	_____ Free Thinking	_____ Logical	_____ Experimenting
_____ Feeling	_____ Alternatives	_____ Analyzing	_____ Evaluating
_____ Action	_____ Divergence	_____ Abstract	_____ Convergence
_____ Direct	_____ Possibilities	_____ Conceptual	_____ Practicalities
_____ Quiet	_____ Trustworthy	_____ Irresponsible	_____ Imaginative
_____ Involved	_____ Proliferating	_____ Theoretical	_____ Testing
_____ Probing	_____ Projecting	_____ Structuring	_____ Examining
_____ Immediate	_____ Gathering	_____ Understanding	_____ Confirming
_____ Impersonal	_____ Proud	_____ Hopeful	_____ Fearful
_____ Implementing	_____ Visualizing	_____ Modelling	_____ Decisive
_____ Present-oriented	_____ Future-oriented	_____ Rational	_____ Detail-oriented
_____ Sympathetic	_____ Pragmatic	_____ Emotional	_____ Procrastinating
_____ Aware	_____ Childlike	_____ Orderly	_____ Realistic
_____ Physical	_____ Guessing	_____ Thinking	_____ Focusing
_____ Trial & Error	_____ Approximately	_____ Pondering	_____ Pinning Down
_____ Concrete	_____ Creating Options	_____ Book Learning	_____ Deciding
_____ Hands on	_____ Staying Open	_____ Reading	_____ Closing
_____ Practice	_____ Transforming	_____ Synthesizing	_____ Choosing
_____ Manipulate	_____ Changing Perspectives	_____ Integrating	_____ Narrowing
_____ Handle	_____ Speculating	_____ Fathoming	_____ Judging
_____ Poking Around	_____ Diversifying	_____ Distilling	_____ Eliminating
_____ Contact	_____ Novelizing	_____ Impersonal	_____ Making Sure

Figure 8

Coding System for Expanded Experimental Inventory Analysis

	X Column 1		I Column 2		T Column 3		E Column 4
1.	Alert	28.	Poised	55.	Ready	82.	Eager
2.	Patient	29.	Diligent	56.	Forceful	83.	Prepared
3.	Doing	30.	Intuitive	57.	Detached	84.	Selective
4.	Experiencing	31.	Optimistic	58.	Objective	85.	Verifying
5.	Reserved	32.	Serious	59.	Fun-loving	86.	Playful
6.	Sensing	33.	Free Thinking	60.	Logical	87.	Experimenting
7.	Feeling	34.	Alternatives	61.	Analyzing	88.	Evaluating
8.	Action	35.	Divergence	62.	Abstract	89.	Convergence
9.	Direct	36.	Possibilities	63.	Conceptual	90.	Practicalities
10.	Quiet	37.	Trustworthy	64.	Irresponsible	91.	Imaginative
11.	Involved	38.	Proliferating	65.	Theoretical	92.	Testing
12.	Probing	39.	Projecting	66.	Structuring	93.	Examining
13.	Immediate	40.	Gathering	67.	Understanding	94.	Confirming
14.	Impersonal	41.	Proud	68.	Hopeful	95.	Fearful
15.	Implementing	42.	Visualizing	69.	Modelling	96.	Decisive
16.	Present-oriented	43.	Future-oriented	70.	Rational	97.	Detail-oriented
17.	Sympathetic	44.	Pragmatic	71.	Emotional	98.	Procrastinating
18.	Aware	45.	Childlike	72.	Orderly	99.	Realistic
19.	Physical	46.	Guessing	73.	Thinking	100.	Focusing
20.	Trial & Error	47.	Approximately	74.	Pondering	101.	Pinning Down
21.	Concrete	48.	Creating Options	75.	Book Learning	102.	Deciding
22.	Hands on	49.	Staying Open	76.	Reading	103.	Closing
23.	Practice	50.	Transforming	77.	Synthesizing	104.	Choosing
24.	Manipulate	51.	Changing Perspectives	78.	Integrating	105.	Narrowing
25.	Handle	52.	Speculating	79.	Fathoming	106.	Judging
26.	Poking Around	53.	Diversifying	80.	Distilling	107.	Eliminating
27.	Contact	54.	Novelizing	81.	Impersonal	108.	Making Sure

A sample (n=107) of managers, supervisors and professionals filled out both formats. Psychometric data were generated using five sets of item groups: the full 21 item groups, the original 12, the additional 9, and two "cuts" achieved by successfully extracting the best item pairs from each of the bi-polar scales' total 21 pairs. The "first cut" extracted the best 15 of the 21 expanded inventory item pairs from each of the X-T and I-E scales and then the "second cut" extracted the best 12 of the 15 first cut item pairs. "Best" was defined as having the highest correlations with the rest of the bi-polar scale item pairs and contributing to high Cronbach alphas for the bi-polar scale.

RESULTS

A. Non-Ipsative Results

The bi-polar scale reliability analyses (item correlations with the rest of the scale and Cronbach alphas) for the expanded 21 item non-ipsative inventory are shown in Tables 1 and 2, and for the original 12 item inventory in Tables 3 and 4 using the expanded inventory improved Cronbach alphas to .82 (X-T) and .86 (I-E) from .73 and .76 respectively.

The 6 item pairs which were dropped from each of the bi-polar X-T and I-E scales of the non-ipsative expanded 21 item inventory to form the first cut, best 15 item pair bi-polar scales are shown in Table 5. The corresponding reliability analyses (Tables 6 and 7) show that the Cronbach alphas remained at the higher levels (.83 and .86 respectively) for X-T and I-E in spite of the reduced number of item pairs. Item pair minimum correlations with the rest of the scale item pairs increased to .29 and .41 for the X-T and I-E scales respectively versus .22 and .21 for the original 12 item inventory.

Table 1

Reliability Analysis

Bi-polar Scale X-T

Item Correlations with Rest of Scale and Cronbach Alpha

Expanded Non-Ipsative Scale, 21 Items

n=107

Item	Scale Mean If Item Deleted	Scale Variance If Item Deleted	Corrected Item Total Correlation	Squared Multiple Correlation	Alpha If Item Deleted
X3T39	80.6916	157.8946	.4439	.4216	.8048
X4T40	82.2523	151.94521	.5085	.5237	.8004
X6T42	82.8318	161.5752	.2476	.6913	.8150
X7T43	82.7477	152.7187	.4683	.6271	.8027
X8T44	80.9252	152.6170	.5034	.5483	.8008
X9T45	81.5514	159.6270	.3469	.5104	.8093
X11T47	81.1308	154.2091	.5246	.4595	.8005
X12T48	81.9720	167.1030	.1254	.3535	.8199
X13T49	82.6262	158.1797	.3445	.3086	.8097
X15T51	81.7290	159.0674	.3748	.4146	.8080
X16T52	82.2617	161.7422	.3039	.3796	.8113
X18T54	81.7290	165.9542	.1795	.3199	.8168
X73T91	82.9813	152.2072	.5373	.4750	.7992
X74T92	82.2336	153.4260	.4939	.4071	.8015
X75T93	81.6729	163.8071	.2292	.4667	.8149
X76T94	81.3738	155.8967	.4463	.4460	.8042
X77T95	81.8598	158.7066	.3749	.3493	.8079
X78T96	82.8037	164.5743	.2346	.3376	.8142
X79T97	81.7664	155.9355	.4648	.4606	.8034
X80T98	82.1776	161.5436	.2916	.3763	.8120
X81T99	81.2430	158.9027	.4034	.3288	.8067

Alpha = .8154

Table 2

Reliability Analysis

Bi-polar Scale I-E

Item Correlations with Rest of Scale and Cronbach Alpha

Expanded Non-Ipsative Scale, 21 Items

n=107

Item	Scale Mean If Item Deleted	Scale Variance If Item Deleted	Corrected Item Total Correlation	Squared Multiple Correlation	Alpha If Item Deleted
I21E57	74.7383	168.6856	.3263	.2337	.8610
I22E58	74.7944	168.5422	.3409	.3376	.8602
I24E60	75.0280	175.2539	.2160	.1618	.8633
I25E61	75.2897	167.0945	.4937	.3780	.8544
I26E62	75.3178	164.1056	.5036	.4472	.8537
I27E63	75.3551	168.7406	.3972	.4323	.8576
I29E65	75.4953	174.3844	.2799	.2085	.8610
I30E66	75.2710	170.6523	.3734	.2800	.8583
I31E67	75.2617	167.4969	.4877	.3899	.8546
I33E69	75.0561	160.9025	.5701	.4554	.8509
I34E70	74.8972	161.2818	.5017	.4127	.8538
I36E72	76.7570	165.2234	.5448	.4894	.8526
I82E100	76.3925	169.3350	.3429	.3337	.8598
I83E101	75.4299	167.6625	.4148	.3695	.8570
I84E102	75.1589	165.2104	.5438	.4380	.8526
I85E103	74.5234	167.1952	.3950	.3904	.8579
I86E104	75.3832	166.7858	.5301	.3980	.8534
I87E105	75.3458	165.3038	.4701	.3782	.8550
I88E106	75.4299	164.7946	.5000	.4250	.8539
I89E107	75.1682	164.9526	.5102	.6112	.8535
I90E108	75.7757	161.662	.6029	.5579	.8500

Alpha = .8619

Table 3

Reliability Analysis

Bi-polar Scale X-T

Item Correlations with Rest of Scale and Cronbach Alpha

Non-Ipsative Scale, 12 Items

n=107

Item	Scale Mean If Item Deleted	Scale Variance If Item Deleted	Corrected Item Total Correlation	Squared Multiple Correlation	Alpha If Item Deleted
X03T39	44.5514	58.5893	.4236	.3476	.7010
X04T40	46.1121	53.5722	.5541	.4350	.6792
X06T42	46.6916	58.5927	.3205	.6482	.7139
X07T43	46.6075	53.6935	.5255	.5934	.6834
X08T44	44.7850	57.7930	.3618	.4412	.7080
X09T45	45.4112	60.5463	.2763	.4344	.7188
X11T47	44.9907	56.2735	.5088	.3854	.6890
X12T48	45.8318	61.5563	.2311	.1928	.7242
X13T49	46.4360	59.7050	.2721	.1869	.7206
X15T51	45.5888	60.2821	.3000	.3145	.7157
X16T52	46.1215	60.3908	.3095	.2785	.7145
X18T54	45.5888	62.3953	.2161	.2415	.7251

Alpha = .7261

Table 4

Reliability Analysis

Bi-polar Scale I-E

Item Correlations with Rest of Scale and Cronbach Alpha

Non-Ipsative Scale, 12 Items

n=107

Item	Scale Mean If Item Deleted	Scale Variance If Item Deleted	Corrected Item Total Correlation	Squared Multiple Correlation	Alpha If Item Deleted
I21E57	41.5047	53.0825	.3384	.1885	.7559
I22E58	41.5607	52.3052	.3927	.2877	.7488
I24E60	41.7944	57.4479	.2073	.1083	.7665
I25E61	42.0561	52.9025	.4843	.2976	.7391
I26E62	42.0841	52.5117	.4146	.3151	.7459
I27E63	42.1215	53.3530	.4105	.3335	.7464
I29E65	42.2617	56.9210	.2796	.1391	.7592
I30E66	42.0374	55.3571	.3331	.1847	.7545
I31E67	42.0280	53.5558	.4506	.3005	.7428
I33E69	41.8224	49.9587	.5259	.3445	.7318
I34E70	41.6636	50.3197	.4456	.2748	.7425
I36E72	43.5234	52.1386	.5174	.3414	.7352

Alpha = .7638

Table 5

Item Pairs Dropped for First Cut Best 15

Scale	Item Pair Dropped		Correlation With Rest of Scale Items	Correlation Rationale For Dropping
X-T	12-48	Probing-Structuring	.1254	<.20
X-T	18-54	Aware-Orderly	.1795	<.20
X-T	6-42	Sensing-Logical	.2476	<.30
X-T	75-93	Concrete-Book-learning	.2292	<.30
X-T	78-96	Manipulate-Integrating	.2346	<.30
X-T	80-98	Poking-Distilling	.2916	<.30
I-E	24-60	Freethinking-Experimenting	.2160	<.30
I-E	29-65	Proliferating-Testing	.2799	<.30
I-E	21-57	Intuitive-Selective	.3263	<.395
I-E	22-58	Optimistic-Verifying	.3409	<.395
I-E	30-66	Projecting-Examining	.3734	<.395
I-E	82-100	Guessing-Focusing	.3429	<.395

Table 6

Reliability Analysis

Bi-polar Scale X-T

Item Correlations with Rest of Scale and Cronbach Alpha

Non-Ipsative Scale, First Cut

Best 15 Item Pairs Selected From Expanded 21 Item Scale

n=107

Item	Scale Mean If Item Deleted	Scale Variance If Item Deleted	Corrected Item Total Correlation	Squared Multiple Correlation	Alpha If Item Deleted
X3T39	57.7103	110.0568	.4697	.3766	.8136
X4T40	59.2710	106.9919	.4622	.4189	.8138
X7T43	59.7664	110.5204	.3288	.2791	.8235
X8T44	57.9439	105.1100	.5428	.4877	.8080
X9T45	58.5701	110.2851	.4140	.4385	.8168
X11T47	58.1495	107.4369	.5290	.4296	.8096
X13T49	59.6449	109.3066	.3961	.2507	.8183
X15T51	58.7477	109.7376	.4473	.3457	.8148
X16T52	59.2804	114.1471	.2936	.3342	.8239
X73T91	60.0000	106.4717	.5164	.4198	.8100
X74T92	59.2523	106.3225	.5147	.3230	.8101
X76T94	58.3925	108.3728	.4685	.3682	.8133
X77T95	58.8785	111.0323	.3857	.3015	.8186
X79T97	58.7850	108.8118	.4730	.3667	.8131
X81T99	58.2617	111.4403	.4066	.3191	.8173

Alpha = .8252

Table 7

Reliability Analysis

Bi-polar Scale I-E

Item Correlations with Rest of Scale and Cronbach Alpha

Non-Ipsative Scale, First Cut

Best 15 Item Pairs Selected From Expanded 21 Item Scale

n=107

Item	Scale Mean If Item Deleted	Scale Variance If Item Deleted	Corrected Item Total Correlation	Squared Multiple Correlation	Alpha If Item Deleted
I25E61	52.4486	107.3440	.4758	.3470	.8528
I26E62	52.4766	104.2707	.5127	.4083	.8508
I27E63	52.5140	107.2522	.4371	.3704	.8547
I31E67	52.4206	108.1705	.4468	.3160	.8541
I33E69	52.2150	102.0383	.5666	.4397	.8478
I34E70	52.0561	101.7327	.5174	.3835	.8510
I36E72	53.9159	106.8136	.4845	.3752	.8523
I83E101	52.5888	107.3953	.4124	.3459	.8560
I84E102	52.3178	105.4075	.5453	.3941	.8494
I85E103	51.68221	105.5019	.4490	.3405	.8544
I86E104	52.5421	106.3449	.5479	.3929	.8496
I87E105	52.5047	104.9127	.4914	.3562	.8520
I88E106	52.5888	105.3010	.4903	.3971	.8520
I89E107	52.3271	105.0524	.5164	.5522	.8506
I90E108	52.9346	102.6655	.6002	.5336	.8462

Alpha = .8601

The three additional item pairs subsequently dropped from each 15 item pair bi-polar scale to provide second cut, best 12 item pair bi-polar scales, are shown in Table 8. Tables 9 and 10 provide the reliability analyses for these second cut bi-polar scales. The Cronbach alphas remained high: .82 (X-T) and .84 (I-E) compared to .73 and .76 for the original 12 item scales. The minimum correlations with the rest of the scale item pairs increased to .39 and .44 for X-T and I-E respectively. A summary of experimental non-ipsative data is provided in Table 11. The two new inventories consolidating the X-T and I-E scales based on the first and second cuts are shown in Figures 9 and 10.

Table 8

Item Pairs Dropped for Second Cut Best 12

Scale	Item Pair Dropped		Correlation With Rest of Scale Items	Correlation Rationale for Dropping Item Pair
X-T	13-49	Immediate-Gathering	.3961	Lowest 3
X-T	16-52	Present Oriented-Rational	.2936	Lowest 3
X-T	7-43	Feeling-Analyzing	.3288	Lowest 3
I-E	83-101	Approximating-Pinning Down	.4124	Lowest 3
I-E	31-67	Gathering-Confirming	.4468	Lowest 3
I-E	85-103	Staying Open-Closing	.4490	Lowest 3

Table 9

Reliability Analysis

Bi-polar Scale X-T

Item Correlations with Rest of Scale and Cronbach Alpha

Non-Ipsative Scale, Second Cut

Best 12 Item Pairs Selected From Expanded 21 Item Scale

n=107

Item	Scale Mean If Item Deleted	Scale Variance If Item Deleted	Corrected Item Total Correlation	Squared Multiple Correlation	Alpha If Item Deleted
X3T39	47.2617	77.3460	.4853	.3645	.8051
X4T40	48.8224	76.6569	.3946	.3563	.8134
X8T44	47.4953	72.3089	.5933	.4787	.7947
X9T45	48.1215	77.0889	.4468	.4255	.8080
X11T47	47.7009	75.3248	.5370	.4237	.8005
X15T51	48.2991	77.0229	.4634	.3238	.8067
X73T91	49.5514	76.3063	.4425	.3493	.8086
X74T92	48.8037	75.2724	.4804	.3004	.8052
X76T94	47.9439	75.0723	.5197	.3570	.8018
X77T95	48.4299	78.2097	.3957	.2942	.8123
X79T97	48.3364	76.4706	.4785	.3511	.8054
X81T99	47.8131	78.5308	.4199	.3070	.8101

Alpha = .8193

Table 10

Reliability Analysis

Bi-polar Scale I-E

Item Correlations with Rest of Scale and Cronbach Alpha

Non-Ipsative Scale, Second Cut

Best 12 Item Pairs Selected From Expanded 21 Item Scale

n=107

Item	Scale Mean If Item Deleted	Scale Variance If Item Deleted	Corrected Item Total Correlation	Squared Multiple Correlation	Alpha If Item Deleted
I25E61	40.3832	72.7291	.4943	.3199	.8322
I26E62	40.4112	70.4142	.5164	.3812	.8304
I27E63	40.4486	72.8157	.4443	.3512	.8356
I33E69	40.1495	69.6567	.5188	.3697	.8303
I34E70	39.9907	68.1037	.5280	.3720	.8301
I36E72	41.8505	72.9774	.4652	.3405	.8341
I84E102	40.2523	71.7753	.5289	.3534	.8297
I86E104	40.4766	72.8556	.5137	.3571	.8311
I87E105	40.4393	71.0977	.4873	.3513	.8326
I88E106	40.5234	71.4782	.4836	.3698	.8328
I89E107	40.2617	70.8931	.5298	.5242	.8294
I90E108	40.8692	69.3035	.5952	.5143	.8244

Alpha = .8430

Table 11

Summary of Reliabilities for Non-Ipsative Inventories and Scales

n=107

Measure	Additional 9 Item Groups Only	Original 12 Item Groups	Expanded to 21 Item Groups	First Cut Best 15 Item Pairs Scale	Second Cut Best 12 Item Pairs Scale
Interscale Correlation (X-T vs I-E)	-.10	.07	-.04	-.16	-.22
Alpha X-T	.72	.73	.82	.83	.82
Alpha I-E	.77	.76	.86	.86	.84

Figure 9

First Cut Best 15 Item Inventory (Including 6 Distractors)

(D)	1. ___ Alert	___ Poised	___ Ready	___ Eager
(D)	2. ___ Patient	___ Diligent	___ Forceful	___ Prepared
	3. ___ Doing	___ Childlike	___ Detached	___ Realistic
	4. ___ Experiencing	___ Diversifying	___ Objective	___ Eliminating
(D)	5. ___ Reserved	___ Serious	___ Fun-loving	___ Playful
	6. ___ **Feeling**	___ Alternatives	___ **Analyzing**	___ Evaluating
	7. ___ Action	___ Divergence	___ Abstract	___ Convergence
	8. ___ Direct	___ Possibilities	___ Conceptual	___ Practicalities
	9. ___ Involved	___ Changing Perspectives	___ Theoretical	___ Narrowing
(D)	10. ___ Quiet	___ Trustworthy	___ Irresponsible	___ Imaginative
	11. ___ **Immediate**	___ **Gathering**	___ **Understanding**	___ **Confirming**
	12. ___ Implementing	___ Visualizing	___ Modelling	___ Decisive
	13. ___ **Present-oriented**	___ Future-oriented	___ **Rational**	___ Detail-oriented
(D)	14. ___ Impersonal	___ Proud	___ Hopeful	___ Fearful
	15. ___ Physical	___ Creating Options	___ Thinking	___ Deciding
	16. ___ Trial & Error	___ **Approximating**	___ Pondering	___ **Pinning Down**
	17. ___ Hands On	___ **Staying Open**	___ Reading	___ **Closing**
(D)	18. ___ Sympathetic	___ Pragmatic	___ Emotional	___ Procrastinating
	19. ___ Practice	___ Transforming	___ Synthesizing	___ Choosing
	20. ___ Handle	___ Speculating	___ Fathoming	___ Judging Down
	21. ___ Contact	___ Novelizing	___ Impersonal	___ Making Sure

Note: 1. Bolded items above indicate the pairs removed to help make the second cut best 12 item pairings (see Figure 6).

2. (D) indicates "Distractor" item group.

Figure 10

Second Cut Best 12 Item Inventory (Including 6 Distractors)

(D)	1.	____ Alert	____ Poised	____ Ready	____ Eager
(D)	2.	____ Patient	____ Diligent	____ Forceful	____ Prepared
	3.	____ Doing	____ Childlike	____ Detached	____ Realistic
	4.	____ Experiencing	____ Diversifying	____ Objective	____ Eliminating
(D)	5.	____ Reserved	____ Serious	____ Fun-loving	____ Playful
	6.	____ Trial & Error	____ Alternatives	____ Pondering	____ Evaluating
	7.	____ Action	____ Divergence	____ Abstract	____ Convergence
	8.	____ Direct	____ Possibilities	____ Conceptual	____ Practicalities
	9.	____ Involved	____ Changing Perspectives	____ Theoretical	____ Narrowing
(D)	10.	____ Quiet	____ Trustworthy	____ Irresponsible	____ Imaginative
	11.	____ Implementing	____ Visualizing	____ Modelling	____ Decisive
	12.	____ Hands On	____ Future-oriented	____ Reading	____ Detail-oriented
	13.	____ Physical	____ Creating Options	____ Thinking	____ Deciding
(D)	14.	____ Impersonal	____ Proud	____ Hopeful	____ Fearful
	15.	____ Practicing	____ Transforming	____ Synthesizing	____ Choosing
	16.	____ Handling	____ Speculating	____ Fathoming	____ Judging
(D)	17.	____ Sympathetic	____ Pragmatic	____ Emotional	____ Procrastinating
	18.	____ Contact	____ Novelizing	____ Impersonal	____ Making Sure

Note: (D) indicates "Distractor" item group.

B. Ipsative Results

Next, using the ipsative three experimental inventories created above (expanded, first cut and second cut), the same calculations were made but this time using the ipsative data from the same sample (n=107). Cronbach alpha calculations were included in this line of experimentation despite our belief that Cronbach alpha is an inappropriate (excessively stringent) measure of internal consistency for a forced choice, ipsative inventory (refer to the discussion in Basadur (1998) on preliminary screening during instrument development and scale construction). In any case, it was decided that Cronbach alpha would be useful for comparative purposes. Table 12 summarizes these experimental data on the ipsative

versions of the three experimental inventories and scales, the original 12 item scale and a scale made up of the additional nine item groups that were added to the 12 item scale to form the expanded 21 item scale .

Table 12

Summary of Reliabilities of Bi-polar Scales in Ipsative Inventory Variations
n=107

Measure	Additional 9 Item Groups	Original 12 Item Groups	Expanded to 21 Item Groups	First Cut Best 15 Item Pairs Scale	Second Cut Best 12 Item Pairs Scale
Interscale Correlation (X-T vs I-E)	-.04	.11	.03	-.18	-.25
Alpha X-T	.55	.66	.75	.74	.75
Alpha I-E	.75	.68	.82	.81	.80

The improvements in Cronbach Alpha for the 21 item, first cut best 15, and second cut best 12 item versions versus the original 12 item version (.75, .74, and .75 vs. .66 for X-T and .82, .81, and .80 vs. .68 for I-E) respectively are most encouraging (and consistent with the non-ipsative data in Table 11) that substantial psychometric improvements to the CPSP are possible with word selection changes. However, the increases in interscale correlations between I-E and X-T for the first and second best cut versions in both Table 11 and 12 indicate the importance of proceeding slowly and carefully with improved item selection work to keep a balance across all psychometric aspects.

Experimenting with Cronbach Alpha on Columns in the Forced Choice Ipsative Inventory Variations

Continuing the experimental approaches above, Cronbach Alphas were calculated using the ipsative forced choice format for each of the four columns for the following five CPSP inventory variations: the additional nine items groups only; the original 12 item groups; the expanded 21 item groups; and the first cut best 15 item pairs and the second cut best 12 item pairs found within the bi-polar scales X-T and I-E of the expanded 21 item groups. The intent was to check how much improvement resulted in Cronbach Alpha as new item groups were added and/or upgraded selections of item pairs or groups were made to the original 12 item inventory. The results are displayed in Table 13 including bi-polar scale results taken from Table 12.

Table 13

Cronbach Alphas for Columns in the Forced Choice, Ipsative Format Variations (n=107)

	Cronbach Alpha				
Column/Scale	Additional 9 Item Groups Only	Original 12 Item Groups	Expanded 21 Item Groups	First Cut Best 15 Item Pairs in X-T and I-E	Second Cut Best 12 Item Pairs in X-T and I-E
Column 1 (X)	.50	.55	.68	.71	.70
Column 2 (I)	.63	.64	.78	.74	.73
Column 3 (T)	.48	.63	.69	.65	.66
Column 4 (E)	.67	.56	.75	.75	.70
Bi-polar X-T	.55	.66	.75	.74	.75
Bi-polar I-E	.75	.68	.82	.81	.80

The reliability improvements shown in Table 14 as item groups are added and upgraded in the forced choice ipsative scales are similar to those achieved for the non-forced choice, non-ipsative scale experiments in Basadur (1998). In a nutshell, Cronbach Alphas generally improve as the number of items increase and as selective cuts are made to exclude item pairs in the X-T and I-E scales which correlate lower with the rest of the item pairs in the same bi-polar scale. Alpha improvements compared to the original 12 item group forced choice inventory move the bi-polar scales to the .75 to .81 range from .66 to .68 and the columns to a range of .69 to .78 from .55 to .64. As expected, these improved values are lower than those of the corresponding non-ipsative versions of the same inventories (see Table 11). However, they are encouraging and quite satisfactory in their own right. The expanded 21 item group inventory alphas are especially satisfactory overall.

Split Half Testing on Two Exploratory Residual Intact Item Group Inventories

Next, on an experimental, "let's see what happens" basis, random split half testing was done on two exploratory inventories. Each was comprised of the residual groups of four items (two item pairs) in the expanded 21 item group inventory (Figures 6, 7, 8) left intact following the first and second cut operations on the X-T and I-E scales as summarized in Tables 5 and 8 and Figures 9 and 10. This created two special eleven and eight item group residual inventories respectively. Spearman-Brown corrected correlation coefficients were calculated for each of the four quadrants using each of these special residual eleven and eight intact item group inventories. In other words, the eleven 4-item groups from the 21 item expanded inventory that stayed intact as unit 4-item groups across the four columns

within the "First Cut, Best 15 Items Pairs" and the eight 4-item groups which emerged similarly intact across the four columns within the "Second Cut, Best 12 Item Pairs" comprised two new residual inventories which were subjected to random split halves reliability testing of the four quadrant scores. The item groups randomly assigned to the two halves were: 8, 9, 13, 16, 18, 74 and 7, 15, 76, 77, 79 for the larger, eleven residual intact item groups inventory and 8, 9, 18, 74 and 15, 76, 77, 79 for the smaller, eight residual intact item groups inventory. Table 14 summarizes the Spearman-Brown corrected correlation coefficients calculated. The ranges of coefficients, .55 to .79 and .61 to .76, are fairly consistent with those of the original 12 item scale. (The ranges across four different samples for the original 12 item scale were .62 to .65, .66 to .73, .67 to .73, and .64 to .72.)

Table 14

Spearman-Brown Corrected Correlation Coefficients (rxx)
on
Two Exploratory Residual Intact Item Group Inventories
(n=107)

	11 Intact Item Groups (Inventory Made Up of the Eleven Intact 4-Item Groups Remaining Within the Selected First Cut Best 15 Item Pairs)	8 Intact Item Groups (Inventory Made Up of the Eight Intact 4-Item Groups Remaining Within the Selected Second Cut Best 12 Item Pairs)
Quadrant	rxx	rxx
Q1	.55	.62
Q2	.79	.76
Q3	.60	.61
Q4	.71	.66

Further Experimenting with Cronbach Alpha on the Two Exploratory Intact Residual Item Group Forced Choice Ipsative Inventories

To extend this experimental process, Cronbach Alphas were calculated for the four columns (X, I, T, E) and two bi-polar scales (X-T and I-E) for the two special ipsative, forced choice, exploratory inventories described above. These were the eleven and eight item group inventories made up of the residual item groups left intact after the first cut best 15 and second cut best 12 item pair extractions on the X-T and I-E scales of the expanded 21 item group experimental inventory. These results are shown in Table 15.

Table 15

Cronbach Alphas for the Two Exploratory Residual Intact Item Group Inventories (Forced Choice, Ipsative Format)

Column/Scale	Cronbach Alphas	
	11 Intact Item Groups	8 Intact Item Groups
Column 1 (X)	.63	.63
Column 2 (I)	.60	.48
Column 3 (T)	.56	.61
Column 4 (E)	.65	.57
Bi-polar X-T	.67	.71
Bi-polar I-E	.71	.63

For the 11 intact residual item group inventory, the Cronbach alpha ranges of .56 to .65 for the columns and .67 to .71 for the bi-polar scales are at least as good as those of the original 12 item group inventory (.55 to .64 and .66 to .68) but not as good as for

the expanded 21 item group inventory (.68 to .78 and .75 to .82) in Table 5. For the 8 intact residual item group inventory, the ranges of .48 to .63 and .63 to .71 are poorer than the original 12 item group inventory, and more similar to the "additional 9 item group" inventory (.48 to .67 and .55 to .75) in Table 5.

SUMMARY AND FUTURE RESEARCH

Overall, the results in Tables 12, 13, 14 and 15 encourage the development of an improved, forced choice (ipsative) inventory of at least 12 item groups which consolidates the best item pairs from the X-T and I-E scales of the expanded 21 item group inventory. This includes further testing of the complete 21 item inventory, which is the best one overall psychometrically but is also the longest (thus, less "user friendly"). One such 12 item scale is shown in Figure 11 as CPSP 12 Item Inventory No. 2 – Experimental. Taking the composite of the second cut best 12 items pairs in the X-T and I-E scales displayed in Figure 10 and adding instructions to the user provides the testable inventory shown in Figure 11. It shuffles together the 12 best item pairs from each of the X-T and I-E scales so that a new set of twelve four-word item groups emerges in a usable, consolidated format. The original six distractor item groups are maintained.

The improved psychometrics of the expanded 21 item group inventory suggest it is also fruitful to test an inventory of more than 12 item groups, tending toward the full 21 item group inventory (or even more). In addition, the effects of modifying the full 21 item group inventory somewhat to exclude the weaker item pairs could be explored. To keep longer inventories short enough to be "user friendly", perhaps the number of distractor items might

be reduced or eliminated. The scoring of selected item groups could be reversed to achieve the same "distractor" effect with fewer total item groups to be responded to. One way or another, the complete 21 item inventory should be tested. It was the best performer of them all.

In net, then, further research should begin as soon as possible to fully test CPSP No. 2 (CPSP 12 Item Inventory No. 2 – experimental) in Figure 11 to examine more thoroughly its improved psychometric properties. In addition, the full expanded 21 item group inventory in Figure 6 should be fully tested, perhaps with the suggestions above of reversing some of the item groups and dropping the distractor items to keep the number of item groups to a user friendly minimum.

Finally, further work should be undertaken to test all possible word pairs within each of the X-T and I-E columns of the expanded 21 item non-ipsative inventory (Figure 7) for maximum stretch within the pair. Frequencies should be run (starting with the n=107 sample data) to determine pairs where at least 50% of respondents differentiated between the words in the pair by at least two or more units (for example, 4-1=3, 3-1=2). Perhaps there are certain words in say, column 1, that could be better paired with certain words in column 3 than to stay paired with the word originally paired with. This effort will lead to further insights on the approach to fine tuning the expanded 21 item group inventory for further testing (with and without distractor item groups) as discussed above.

Figure 11

CPSP 12 Item Problem Solving Inventory No. 2 – Experimental

This inventory is designed to describe your method of problem solving. Give a high rank to those words which best characterize the way you problem solve and a low rank to the words which are least characteristic of your problem solving style.

You may find it hard to choose the words that best describe your problem solving style because there are no right or wrong answers. Different characteristics described in the inventory are equally good. The aim of the inventory is to **describe how** you solve problems, **not to evaluate** your problem solving ability.

Instructions:

Eighteen sets of four words are listed horizontally below. In each horizontal set assign a four (4) to the word which best characterizes your problem solving style, a three (3) to the word which next best characterizes your problem solving style, a two (2) to the next most characteristic word, and a one (1) to the word which is least characteristic of you as a problem solver. Be sure to assign a different number to each of the four words in each horizontal set. Do not make ties.

1.	____ Alert	____ Poised	____ Ready	____ Eager
2.	____ Patient	____ Diligent	____ Forceful	____ Prepared
3.	____ Doing	____ Childlike	____ Detached	____ Realistic
4.	____ Experiencing	____ Diversifying	____ Objective	____ Eliminating
5.	____ Reserved	____ Serious	____ Fun-loving	____ Playful
6.	____ Trial & Error	____ Alternatives	____ Pondering	____ Evaluating
7.	____ Action	____ Divergence	____ Abstract	____ Convergence
8.	____ Direct	____ Possibilities	____ Conceptual	____ Practicalities
9.	____ Involved	____ Changing Perspectives	____ Theoretical	____ Narrowing
10.	____ Quiet	____ Trustworthy	____ Irresponsible	____ Imaginative
11.	____ Implementing	____ Visualizing	____ Modelling	____ Decisive
12.	____ Hands On	____ Future-oriented	____ Reading	____ Detail-oriented
13.	____ Physical	____ Creating Options	____ Thinking	____ Deciding
14.	____ Impersonal	____ Proud	____ Hopeful	____ Fearful
15.	____ Practicing	____ Transforming	____ Synthesizing	____ Choosing
16.	____ Handling	____ Speculating	____ Fathoming	____ Judging
17.	____ Sympathetic	____ Pragmatic	____ Emotional	____ Procrastinating
18.	____ Contact	____ Novelizing	____ Impersonal	____ Making Sure

* The item groups are identical to those in Figure 10.

REFERENCES

Basadur, M.S. (1998). The Basadur Simplex creative problem-solving profile inventory: Development, reliability and validity. Management of Innovation and New Technology Research Centre Working Paper No. 83, McMaster University, Hamilton, Ontario, Canada L8S 4M4.

Basadur, M.S., Graen, G.B., & Wakabayashi, M. (1990). Identifying individual differences in creative problem solving style. Journal of Creative Behavior, 24 (2).

Kirton, M.J. (1987). KAI Manual. Occupational Research Centre, P.O. Box 109, Hatfield, Hertsford, AL10 9AB, U.K.

Kirton, M.J. (1976). Adaptors and innovators: A description and measure. Journal of Applied Psychology, 61, 622-629.

Myers, I.B. (1962). Myers-Briggs Type Indicator Manual. Princeton, NJ: Educational Testing Service.

APPENDIX

The Four Styles of the Basadur CPSP Inventory

I. Generating

Individuals who prefer generating tend to gain knowledge through direct experience and to use it to create options, or diverge, rather than evaluate options, or converge. A generator creates options in the form of new possibilities – new problems that might be solved and new opportunities that might be capitalized upon. Generators like to question, imagine possibilities, sense new problems and opportunities, and view situations from different perspectives. They see relevance in almost everything and think of good and bad sides to almost any fact, idea or issue. They dislike becoming too organized or delegating the complete problem, but are willing to let others take care of the details. They enjoy ambiguity and are hard to pin down. They delight in juggling many new projects simultaneously. Every solution they explore suggests several new problems to be solved. Thinking in this quadrant stresses problem and opportunity finding, and information gathering, the first two steps of the Simplex eight step innovation process.

II. Conceptualizing

Conceptualizing also involves divergence. But rather than gain knowledge by direct experience, individuals who favor conceptualizing tend to gain knowledge by detached, abstract thinking. A conceptualizer creates options in the form of alternate ways to understand and define a problem or opportunity and good ideas that help solve it. Conceptualizers enjoy putting new ideas together, discovering insights that help define

problems and opportunities, and creating theories to explain things. People and organizations strong in conceptualizing skills enjoy taking disparate pieces of information from the generator stage and making sense of them. Conceptualizers need to "understand": to them, a theory must be logically sound and precise. They prefer to proceed only with a clear grasp of the big picture, and only when the challenge or main idea is well-defined. They dislike having to prioritize, implement or agonize over poorly understood alternatives. They like to play with ideas and are not overly concerned with moving to action. Thinking in this quadrant stresses problem and opportunity defining, and idea finding, the third and fourth steps of the Simplex innovation process.

III. Optimizing

Optimizing is the opposite of generating. Optimizers prefer to gain knowledge through detached, abstract thinking and to use it to converge, thus converting abstract ideas and alternatives into practical solutions and plans. An optimizer creates options in the form of ways to get an idea to work in practice and uncovering all the factors that go into a successful plan for implementation. They rely upon mentally testing ideas rather than upon trying things out. Optimizers prefer to create optimal solutions to a few well-defined problems or opportunities. They are adept at sorting through large amounts of information to pinpoint "what's wrong" in a given situation. They are confident in their ability to make a sound, logical evaluation and to select the best option or solution. They often lack patience with ambiguity and dislike dreaming about additional ideas, points of view or relations among problems or opportunities. They believe they "know" what the problem is. Thinking

in this quadrant stresses idea evaluation and selection, and planning for implementation, the fifth and sixth steps in the Simplex innovation process.

IV. Implementing

Implementing is the opposite of conceptualizing. Implementers prefer to gain knowledge by direct experience rather than by detached, abstract thinking, and to use knowledge to converge. An implementer creates options in the form of actions that get results and gain acceptance for implementing a change or a new idea. They enjoy getting things done – implementing new solutions. They try out ideas rather than mentally test them. People and organizations strong in implementing prefer situations in which they must somehow make things work. They do not need complete understanding in order to proceed, and adapt quickly to immediate, changing circumstances. When a theory does not appear to fit the facts, they will readily discard it. Others perceive them as enthusiastic about getting the job done, but also as impatient or even pushy as they try to turn plans and ideas into action. They will try as many different approaches as necessary, and follow up or "bird dog" as needed to ensure that the new procedure will stick. Thinking in this quadrant stresses gaining acceptance and taking action, the seventh and eighth steps of the Simplex innovation process.

MANAGEMENT OF INNOVATION AND NEW TECHNOLOGY
WORKING PAPER SERIES

1. R.G. Cooper and E.J. Kleinschmidt, "How the New Product Impacts on Success and Failure in the Chemical Industry", February, 1992.

2. R.G. Cooper and E.J. Kleinschmidt, "Major New Products: What Distinguishes the Winners in the Chemical Industry", February, 1992.

3. J. Miltenburg, "On the Equivalence of JIT and MRP as Technologies for Reducing Wastes in Manufacturing, March, 1992.

4. J.B. Kim, I. Krinsky and J. Lee, "Valuation of Initial Public Offerings: Evidence from Korea", February, 1992.

5. M. Basadur and S. Robinson, "The New Creative Thinking Skills Needed for Total Quality Management to Become Fact, Not Just Philosophy", April, 1992.

6. S. Edgett and S. Parkinson, "The Development of New Services Distinguishing Between Success and Failure", April, 1992.

7. A.R. Montazemi and K.M. Gupta, "Planning and Development of Information Systems Towards Strategic Advantage of a Firm", April, 1992.

8. A.R. Montazemi, "Reducing the Complexity of MIS Innovation Through Hypermedia and Expert Systems", May, 1992.

9. M. Basadur and Bruce Paton, "Creativity Boosts Profits in Recessionary Times - Broadening the Playing Field", June, 1992.

10. Robert G. Cooper and Elko Kleinschmidt, "Stage-Gate Systems for Product Innovation: Rationale and Results", June, 1992.

11. S.A.W. Drew, "The Strategic Management of Innovation in the Financial Services Industry: An Empirical Study", July, 1992.

12. M. Shehata and M.E. Ibrahim, "The Impact of Tax Policies on Firms' R & D Spending Behavior: The Case of R & D Tax Credit", July, 1992.

13. Willi H. Wiesner, "Development Interview Technology: Implications for Innovative Organizations", July, 1992.

14. Isik U. Zeytinoglu, "Technological Innovation and the Creation of a New Type of Employment: Telework", August, 1992.

15. John W. Medcof, "An Integrated Model for Teaching the Management of Innovation in the Introduction to Organizational Behaviour Course", October, 1992.

16. Min Basadur, "The Why-What's Stopping Analysis: A New Methodology for Formulating Ill-Structured Problems", October, 1992.

17. Stephen A.W. Drew, "Strategy, Innovation and Organizational Learning an Integrative Framework, Case Histories and Directions for Research", November, 1992.

18. Stephen A.W. Drew, "Innovation and Strategy in Financial Services", November, 1992.

19. Scott Edgett, "New Product Development Practices for Retail Financial Services", November, 1992.

20. Robert G. Cooper and Elko J. Kleinschmidt, "New Product Winners and Losers: The Relative Importance of Success Factors - Perception vs. Reality", November, 1992.

21. Robert G. Cooper and Elko J. Kleinschmidt, "A New Product Success Factors Model: An Empirical Validation", November, 1992.

22. Robert G. Cooper & Elko J. Kleinschmidt, "Stage Gate Systems: A Game Plan for New Product Success", November, 1992.

23. Min Basadur, "Optimal Ideation-Evaluation Ratios", March, 1993.

24. Christopher K. Bart, "Gagging on Chaos", March, 1993.

25. Yufei Yuan, "The Role of Information Technology in Business Innovation", July, 1993.

26. Isik Urla Zeytinoglu, "Innovation in Employment: A Telework Experiment in Ontario", July, 1993.

27. John Miltenburg and David Sparling, "Managing and Reducing Total Cycle Time: Models and Analysis", August, 1993.

28. R.G. Cooper, C.J. Easingwood, S. Edgett, E.J. Kleinschmidt and C. Storey, "What Distinguishes the Top Performers in Financial Services", September, 1993.

29. B.E. Lynn, "Innovation and Accounting Research", September, 1993.

30. Min Basadur and Peter Hausdorf, "Measuring Additional Divergent Thinking Attitudes Related to Creative Problem Solving and Innovation Management", November, 1993.

31. R.G. Cooper and E.J. Kleinschmidt, "Determinants of Time Efficiency in Product Development", December, 1993.

32. Christopher K. Bart, "Back to the Future: Timeless Lessons for Organizational Success", February, 1994.

33. Ken R. Deal and Scott J. Edgett, "Determining Success Criteria for New Financial Products; A Comparative Analysis of CART, Logit and Discriminant Analysis", February, 1995.

34. Christopher K. Bart and Mark C. Baetz, "Does Mission Matter?", February, 1995.

35. Christopher K. Bart, "Controlling New Products: A Contingency Approach", February, 1995.

36. Christopher K. Bart, "Is Fortune Magazine Right? An Investigation into the Application of Deutschman's 16 High-Tech Management Practices", February, 1995.

37. Christopher K. Bart, "The Impact of Mission on Firm Innovativeness", February, 1995.

38. John W. Medcof, "Transnational Technology Networks", April, 1995.

39. R.G. Cooper and E.J. Kleinschmidt, "Benchmarking the Critical Success Factors of Firms' New Product Development Programs", April, 1995.

40. John W. Medcof, "Trends in Selected High Technology Industries", July, 1995.

41. Robert C. Cooper & E.J. Kleinschmidt, "Benchmarking Firms' New Product Performance & Practices", September, 1995.

42. Min Basadur and Darryl Kirkland, "Training Effects on the Divergent Thinking Attitudes of South American Managers", November, 1995.

43. Min Basadur, "Organizational Development Interventions for Enhancing Creativity in the Workplace", November, 1995.

44. Min Basadur, "Training Managerial Evaluative and Ideational Skills in Creative Problem Solving: A Causal Model", December, 1995.

45. Min Basadur, Pam Pringle and Simon Taggar, "Improving the Reliability of Three New Scales Which Measure Three New Divergent Thinking Attitudes Related to Organizational Creativity", December, 1995.

46. N. P. Archer and F. Ghasemzadeh, "Project Portfolio Selection Techniques: A Review and a Suggested Integrated Approach", February, 1996.

47. Elko J. Kleinschmidt, "Successful new product development in Australia: An empirical analysis", February, 1996.

48. Christopher K. Bart, "Industrial Firms & the Power of Mission," April, 1996.

49. N. P. Archer and F. Ghasemzadeh, "Project Portfolio Selection Management through Decision Support: A System Prototype," April, 1996.

50. John W. Medcof, "Challenges in Collaboration Management in Overseas Technology Units," April, 1996.

51. Susan L. Kichuk and Willi H. Wiesner, "Personality and Team Performance: Implications for Selecting Successful Product Design Teams," May, 1996.

52. Susan L. Kichuk and Willi H. Wiesner, "Selection Measures for a Team Environment: The Relationships among the Wonderlic Personnel Test, The Neo-FFI, and the Teamwork KSA Test, " May, 1996.

53. Susan L. Kichuk and Willi H. Wiesner, "Personality, Performance, Satisfaction, and Potential Longevity in Product Design Teams," June, 1996.

54. John W. Medcof, "Learning, Positioning and Alliance Partner Selection," June, 1996.

55. Scott J. Edgett, "The New Product Development Process for Commercial Financial Services," July, 1996.

56. Christopher K. Bart, "Sex, Lies & Mission Statements," September, 1996.

57. Stuart Mestelman and Mohamed Shehata, "The Impact of Research and Development Subsidies on the Employment of Research and Development Inputs," November, 1996.

58. Mark C. Baetz and Christopher K. Bart, "Developing Mission Statements Which Work," November, 1996.

59. Fereidoun Ghasemzadeh, Norm Archer and Paul Iyogun, "A Zero-One Model for Project Portfolio Selection and Scheduling," December, 1996.

60. R. G. Cooper, S. J. Edgett, E. J. Kleinschmidt, "Portfolio Management in New Product Development: Lessons from Leading Firms," February 1997.

61. R. G. Cooper, S. J. Edgett, E. J. Kleinschmidt, "Portfolio Management in New Product Development: Lessons from Leading Firms -- Part II," February 1997.

62. C. K. Bart, "A Comparison of Mission Statements & Their Rationales in Innovative and Non-Innovative Firms," February 1997.

63. R. Bassett, N. P. Archer and W. G. Truscott, "Data Webs: An Evaluation of an Innovative Information Management Tool that Integrates Databases with the World Wide Web," April 1997.

64. S. Taggar, "Intelligence, Personality, Creativity and Behaviour: The Antecedents of Superior Team Performance," April 1997.

65. R. Deaves and I. Krinsky, "New Tools for Investment Decision-Making: Real Options Analysis," May 1997.

66. J. W. Medcof (ed.), "Trends and Events in Selected High Technology Industries," May, 1997. (On the WEB only)

67. C. K. Bart, "Product Innovation Charters: A State-of-the-Art Review," May, 1997.

68. John W. Medcof, "Strategic Contingencies and Power in Networks of Internationally Dispersed R&D Facilities", August, 1997.

69. John W. Medcof, "Research Intensity and the Identification of High Technology Industries," September, 1997.

70. Christopher K. Bart and John C. Tabone, "Mission Statements in the Not-for-profit Health Care Sector: A State of the Art Review," September, 1997.

71. Elko J. Kleinschmidt, "In-house and Partnership New Product Development in Austria: An Empirical Analysis on Outcome and Explanatory Factors," October, 1997.

72. Robert G. Cooper, Scott J. Edgett and Elko J. Kleinschmidt, "R&D Portfolio Management Best Practices: Methods Used & Performance Results Achieved," January, 1998.

73. Christopher K. Bart and Simon Taggar, "A Model of the Impact of Mission Rationale, Content, Process and Alignment on Firm Performance," March, 1998.

74. Christopher K. Bart, John Parkinson and Simon Taggar, "The Implementation of Strategy: Behavioural vs Budgetary Approaches and the Effect of Participation," March, 1998.

75. John W. Medcof, "The Resource Based View and the New Competitive Landscape: Characterizing Positions of Dynamic Capability," May, 1998.

76. F. Ghasemzadeh and N. P. Archer, "Project Portfolio Selection Through Decision Support," June, 1998.

77. Y. Yuan, N. Archer, and R. Bassett, "The Impact of Electronic Commerce Innovations on Marketing Management," June, 1998.

78. Kenneth S. Chan, James Chowhan, Stuart Mestelman, Mohamed Shehata, "Value Orientations and Income and Displacement Effects," July 1998.

79. Min Basadur, Laurent Lapierre, "Predicting Creative Problem Solving Behaviors within Teams," September, 1998.

80. Min Basadur, "Simplex: Modelling the Phases and Stages of the Innovation Process in Open-System Organizations, October, 1998.

81. Ken Deal, Ben Long and Bryan Scott, "New Pricing Product Design for Competitive Advantage, November, 1998.

82. Min Basadur, Mark A. Runco and Luis A. Vega, "Understanding How Creative Thinking Skills, Attitudes and Behaviors Work Together in Real World Managerial Problem Solving," November, 1998.

83. Min Basadur, "The Basadur Simplex Creative Problem-Solving Profile Inventory: Development, Reliability and Validity, December, 1998.

Innis
REF
HD
45
.W657
no. 84

The activities of the Management of Innovation and New Technology Research Centre are generously supported by:

- The DeGroote family
- DuPont Canada Inc
- Nortel
- Royal Bank
- The Society of Management Accountants of Ontario

McMASTER
UNIVERSITY
MICHAEL G. DeGROOTE
SCHOOL OF BUSINESS

INFORMATION . . .

For information about the Management of Innovation and New Technology Research Centre or innovation research activities at the Michael G. DeGroote School of Business:

Director; Dr. C. K. Bart, Ph.D., C.A.
MINT - Research Centre
Michael G. DeGroote School of Business
McMaster University, 1280 Main St. W.
Hamilton ON Canada L8S 4M4

Phone: 905-525-9140, Ext. 24105
Fax: 905-521-8995
email: mint@mcmaster.ca
www: http://mint.mcmaster.ca/

*Management of Innovation and New Technology Research Centre (MINT) is an official mark of the Michael G. DeGroote School of Business, McMaster University.