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## Hierarchy of Abstraction Modelling (H.A.M.) and the Psychometric Validation of Grounded Theory Research

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### ABSTRACT

The main aim of this article is to advocate the practice of *Hierarchy of Abstraction Modelling* (HAM) as a means of reflecting the abstract representation of constructs. This representation is tracked from manifest variable through low order category to higher order category, to basic social process. This article reports on research that operationalises qualitatively derived grounded theories with a questionnaire format. This work provides support for the three proposed *Social Processes of Leadership* (SPL) constructs that emerged from previous grounded theory research. In addition, four lower order factors were found. Structural equation modelling using AMOS software provided a model which reflected a hierarchy of abstraction. That model had adequate indices of fit. The model also supported and validated the hierarchy of abstraction represented with the grounded theory findings. Concurrent validity was concluded from positive correlations between SPL constructs and established leadership measures. In particular, aspects of the SPL demonstrated high correlations with transformational leadership constructs. Ongoing grounded theory based research into the social processes of leadership and influence in organizations is supported.

An assertion made by leadership theorists in recent years is that leadership is a social process of influence (Bass, 1998; Conger, 1998; Parry, 1998; Rost, 1993; Yukl, 1994). Reflecting a growing consensus about the social and processual nature of leadership, new and innovative forms of leadership research have recently been called for (Conger, 1998; Horner, 1997; Parry, 1998), and increasingly produced. For example, Grounded Theory (hereinafter as GT - Glaser & Strauss, 1967) has been used by researchers to derive basic social processes of leadership (Irurita, 1994, 1996; Parry, 1999). GT method uses qualitative data mainly, and fully qualitative analysis of those data producing detailed, in-depth and contextually relevant data and theory. Therefore, GT offers a useful form of analysis for the investigation of leadership processes that extends beyond traditional static methods. A number of theorists (Clegg and Hardy, 1996; Weick, 1999; Flyvbjerg, 2001) are calling for an end to the 'paradigm wars' between qualitative and quantitative approaches and suggest that it is time for researchers to bridge the gap between those two approaches. This paper is presented in the spirit of this calling.

There is a trade off for GT between complexity/depth and generalisability/breadth. Although it is possible that grounded theory analysis of social processes is relevant to a range of organizational contexts, its substantive nature means this cannot be assumed for each set of research findings. Further alternative analyses providing more generalisable results are required for the extension of such leadership theory.

The current research commences this task by operationalising previously developed substantive qualitative theory of the social processes of leadership into a quantitative research tool. This quantitative representation is then used to explore relationships between SPL and theoretically similar constructs that have been derived from nomothetic epistemologies and methods.

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## **SOCIAL PROCESSES OF LEADERSHIP**

There has been a growing awareness that leadership is a social process and thus a highly complex phenomenon created through actions, behaviours and relationships of multiple actors (Horner, 1997). As mentioned above, work has begun to investigate this complex social nature of leadership. In particular, three theories of the social process of leadership were analysed: *Optimising* (Irurita, 1994, 1996), *Resolving Uncertainty*, and *Enhancing Adaptability* (Parry, 1999). These theories are important and useful because they have begun to look at leadership as a dynamic social process that a) involves the transformation of beliefs, actions, and motivations over time and b) involves interactional linkages between a range of variables and individuals at many different levels (Proctor & Parry, 1999). A summary of each theory follows shortly.

Although each of the following social processes of leadership were originally conceptualised within dyadic relationships, I suggest that all work unit members contribute to the social process of leadership. Behaviours exhibited by members of a work unit and interactional processes between members are likely to promote or limit effects of optimising, resolving uncertainty or enhancing adaptability. Therefore, analysis of these processes at a group level makes an important addition to previous theory.

### **Optimising**

Irurita (1996) presented one example of important research into the leadership process. In this research, Irurita conducted a qualitative analysis of nursing leadership using the grounded theory method (see Glaser, 1992; Glaser & Strauss, 1967; Glaser, 1978; Strauss, 1987; Strauss & Corbin, 1990). Grounded theory enables theory generation from data rather than using data to support already formed theories (Irurita, 1996). Because leadership *social processes of influence* are as yet minimally understood and theorized, it is therefore a very exciting and promising approach for investigation in this area (Parry, 1998).

From data collected over four years, Irurita formed a theory of *optimising* (Irurita, 1990, 1992, 1994). Optimising is a term given to the effective leadership process of “making the best of the situation, making the most effective or optimal use of all available and potential resources to compensate for the state of retardation and to move beyond mediocrity toward excellence” (Irurita, 1996:129).

Optimising involves three progressive phases of process, where an organization may be in a period of *surviving*, *investing* or *transforming* (Irurita, 1996). The transforming phase takes the organization from retardation and mediocrity in which basic survival is the focus, through turbulence, in which investing is key, and on towards excellence, a period of continuous development and transformation (Irurita, 1996). Irurita’s model of optimising is conceptually more similar to *Transformational Leadership* (Bass & Avolio, 1993; Podsakoff, MacKenzie, Moorman, & Fetter, 1990) than to other leadership theories. Leaders who work on the basis of contingent reward and management-by-exception are classified in the optimising model as survivors. On the other hand, leaders who are investing or transforming in the optimising model are clear examples of successful leaders as described in Bass’ transformational leadership theory (Irurita, 1996).

### **Resolving Uncertainty & Enhancing Adaptability**

Parry (1999) also used qualitative methods and grounded theory to explore the leadership processes occurring amidst turbulent change in Australian local government settings. Through this work, two social processes were found to occur in relation to leadership, change and following. These social processes involve *resolving uncertainty* and *enhancing adaptability* of followers and the leaders in organizations.

#### *Resolving Uncertainty*

Parry (1999) found that where effective leadership processes were present, the uncertainty of change of both the followers and leaders could be resolved through strategies, behaviours and activities demonstrated by the leaders. Moreover, in the absence of effective leadership, both leaders and followers can become consumed with uncertainty, and their knowledge, performance and morale

may reduce while inaccurate perceptions are maintained. Within the process of resolving uncertainty it is important for the leader to have a clear understanding of their leadership role. A leader's self-awareness of personal adaptability helps them to be in a position to help increase the adaptability of their followers through strategies such as identifying positive outcomes of the change, and giving followers experience of success through the change. Therefore, the two characteristics of the social process of resolving uncertainty, at a lower level of abstraction, are (a) improving knowledge and perceptions and (b) role clarity and personal adaptability.

However, because resolving uncertainty is a *reactive* process and is a short-term strategy that is more curative than preventative, it is ineffectual in isolation. Rather, it is more effective to help others prepare for the future by developing personal capabilities, such as adaptability, that can preempt the negative effects of change (Cabana, 1996; Parry, 1998).

### *Enhancing Adaptability*

Through deeper analysis of the data Parry (1999) identified some key strategies of enhancing adaptability that the process of resolving uncertainty lacked. For example, in order to enhance followers' adaptability and their own adaptability, leaders can influence change in their follower's perceptions, create reciprocal commitment, improve knowledge of reciprocal benefits of changes, consistently and clearly communicate desirable messages, facilitate experiences of different change situations for followers and achieve complementarity of values, (Parry, 1999:145).

The theories of resolving uncertainty and enhancing adaptability are conceptually more similar to the construct of transformational leadership, than to leadership theory more generally. For example, just as transformational leaders need to be self-confident and clear of their purpose and direction in order to motivate, stimulate and inspire (Avolio, 1996), so too do leaders who want to enhance the adaptability of others and of themselves.

## **RESEARCH OBJECTIVES**

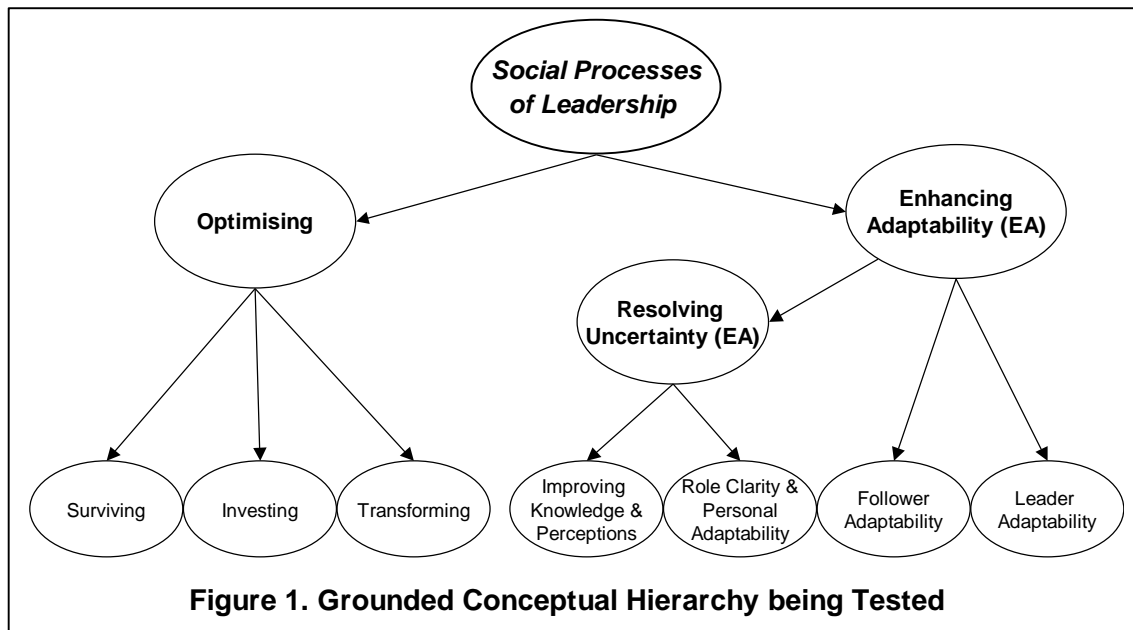
This investigation begins with the development of a scale founded in grounded theory research. This scale identified the presence of social processes of leadership in organisational settings (Irurita, 1996; Parry, 1997). By quantitatively analysing the resulting questionnaire data, the objective is to determine whether the separate social processes of leadership would still emerge as discreet constructs. A concomitant objective would be to ascertain whether any sub-constructs at lower levels of abstraction were present. The implication inherent within this work is that the 'knitting together' of methodologies will strengthen the theoretical position more than either qualitative or quantitative identification of the processes of leadership in isolation, would allow.

### **Intended Outcomes**

Therefore, there are three intended outcomes from this line of research:

1. An attempt to validate extant social process of leadership (SPL) theories that have been undertaken using the grounded theory method.
2. Testing for the presence of discrete sub-constructs at lower levels of abstraction.
3. To determine relationships between existing leadership/organizational constructs and SPL theory.

The proposed model being tested consists of three leadership processes that are related with each other conceptually, and collectively contribute to a higher order SPL construct (see Figure 1). Note that the grounded theory research found that resolving uncertainty was a high-order social process of leadership, and that it was also a sub-construct of the basic social process of enhancing adaptability.



## SCALE DEVELOPMENT

A critical guideline of the SPL scale development was to design a tool that was applicable to a range of organizational and industrial settings, and thus test what was essentially substantive work in more generalisable settings. As such, the items were developed to avoid industry- or organizational-specific language and were based on behavioural social processes rather than detailed descriptions of work roles.

Original grounded theory write-ups were content-analysed to derive a fuller list of items describing the particular characteristics of the social processes of leadership. In addition, the current analysis was aimed at developing items that reflect collective practices of leadership that may occur within a group context.

Through a progressive item development and refinement phase, 39 items were selected to represent the three social processes of leadership under investigation. The item response scale chosen was a five-point ratio-scale of frequency, ranging from 'not at all' to 'frequently, if not always'.

## METHOD

### Sample and Procedure

Data were collected from 920 usable surveys completed by middle and senior managers drawn from a membership list of the New Zealand Institute of Management. There were two versions of the questionnaire. The 39 SPL items were included in both questionnaires, and related instruments, included for the purpose of testing for convergent validity, were spread across both of these (Questionnaires 1 and 2 consisted of 113 and 111 items respectively). Scale analysis was conducted using the combined data set drawing on the SPL item responses from both Questionnaire 1 and 2. Because instruments were included for convergent validity, there is the possibility that a theme of 'leadership' was present in the survey. This may have skewed the data and potentially made discrimination between variables and constructs even more difficult.

The surveys required raters to evaluate leadership processes and behaviours within their 'team' or 'work unit'. Questionnaires were posted out to members with a letter of support from the Chief Executive of the Institute of Management. Surveys were self-administered and when completed, returned in reply-paid envelopes. Each member received only one of the two versions of the questionnaire, selected at random.

A total of 4470 questionnaires were mailed out, and thus the response rate across the two versions of the survey was approximately 21%. In order to ascertain whether the low response rate was likely to produce biased results, a non-response analysis developed by Moser & Kalton (1971)

was conducted. This is also referred to as *wave analysis* (Rainey, Sanjay & Bozeman, 1995). Cross-tabulation analyses of early (within the first two weeks), medium (two-three weeks) and late (after three weeks) responses were performed against all demographic characteristics and measurement scales in the survey and results suggest a low possibility of response bias (Moser and Kalton, 1971).

The majority of the respondent sample of 920 were involved in mainly private sector enterprise (58%), while the remaining 42% worked mainly in the public sector. 75% of survey participants had been in their work units for more than 1½ years, while only six per cent had worked in their unit for less than six months. The average work unit size had approximately 20 members with a relatively even split between men and women (55% and 45% respectively). However, the gender of the respondents was not evenly distributed (71% men, 29% women). The age of respondents ranged between 21-79 years with a mean age of 47 years, and 91% of this sample were of middle management level or higher. These statistics suggest that a large proportion of the work unit sample probably operated at management or senior management level.

## Measures

Many scales measure organisational processes that contribute to leadership. By using some of these in the present research it was hoped that the convergent validity of the SPL scale and construct could be determined. However, the majority of these scales were originally developed to measure individual characteristics. For the purposes of this investigation it was necessary to re-word some scales to reflect a team context. The reliabilities of the new 'team' scales were assessed to ensure the use of appropriate measures. All scales provided better than adequate Cronbach Alpha reliability scores and item-to-total correlations. The following constructs were measured across the two versions of the survey. For example the Bass & Avolio scale was on one questionnaire and the Podsakoff scale was on the other questionnaire. Also, the five organisational citizenship sub-scales were allocated between the two questionnaires. The convergent validity scales were:

?? *Transformational and Constructive Transactional Leadership* (Bass & Avolio, 1993; Podsakoff et al., 1990).

?? *Climate for Innovation* (Scott & Bruce, 1994).

?? *Humour* (Dubinsky, Yammarino, & Jolson, 1995).

?? *Organizational Citizenship* (Podsakoff et al., 1990).

?? *Cohesion* (Carless & DePaola, 2000)

?? *Work Group Characteristics* (Campion, Medsker & Higgs, 1993).

?? *Trustworthiness* (Pearce, Branyiczki, and Bakacsi, 1994).

Questions were also asked about the demographic characteristics of respondents and their work units.

## Confirmatory Factor Analysis Techniques

Comparisons of models were undertaken using the AMOS 4.0 Structural Equation Modelling procedure (Arbuckle & Wothke, 1999) in SPSS 10. AMOS 4.0 uses the Maximum Likelihood Estimation Method to determine fit indices of a specified model by comparing the estimated covariance matrix with that of the observed data. Fit indices that are produced in this analysis include the *Goodness of Fit Index* (GFI) (Jöreskog & Sörbom, 1984; Tanaka & Huba, 1985), the *Adjusted Goodness of Fit Index* (AGFI), which takes into account the degrees of freedom available for testing the model, the *Normed Fit Index* (NFI) (Bentler-Bonnet, 1980), *Tucker-Lewis coefficient* (TLI) (Bentler-Bonnet, 1980), and the *Comparative Fit Index* (CFI) (Bentler, 1990). In all of these, 1 indicates perfect fit and values over .9 are generally thought to indicate adequate fit (Arbuckle & Wothke, 1999). The *Chi-square* distribution, *Root Mean Square Residual* (RMR), and *Root Mean Square Error of Approximation* (RMSEA, Browne & Cudeck, 1993) can also be calculated. These indices measure how *badly* the proposed model fits the data. For both RMR and RMSEA 0.0 indicates

perfect fit, but models that score 0.8 or less on RMSEA and 0.5 or less on RMR are also usually thought to indicate reasonable fit (Browne & Cudeck, 1993).

## RESULTS & ANALYSIS

### *Exploratory & Confirmatory Factor-Analysis*

In addition to running a CFA of the theoretically derived 3-factor structure (representing the three grounded theory-derived social processes of leadership), alternative models that were defensible from previous literature and supported in the data, were also compared. As such, the proposed 3-factor model was compared with a 1-factor and a 4-factor solution that were derived through exploratory factor analyses and supportable within the extant literature.

Through exploratory factor analyses, reliability tests and inter-item correlation analysis, the results suggested a clustering effect of all reverse-coded items, despite originating from distinct SPL theories. It is likely that this clustering is more a function of problematic wording or systematic response-bias (Jackson, Wall, Martin, & Davids, 1993), than a replicable factor structure of the social process of leadership. For this reason all 8 reverse-scored items were withdrawn from further analyses.

### *Proposed Model Solution*

Using the remaining 31 items a confirmatory factor analysis (CFA) was performed on the proposed factor structure. As Table 1 demonstrates, the specified three-factor solution did not fit the data adequately. Using item-to-total correlations and factor loadings, item trimming of poor fitting items was conducted in an attempt to improve fit. An adjusted three-factor solution, representing the three original constructs and consisting of 21 items, demonstrated adequate fit when a CFA was run. Fit indices for this adjusted three-factor model are also presented in Table 1.

**Table 1. Indices of Fit for Alternative Model Factor Structures  
for the Social Process of Leadership Scale**

| Index             | NUMBER OF FACTORS IN MODEL                                    |   |  |  |
|-------------------|---|---|--|--|
|                   | <i>Original<br/>Proposed 3-<br/>factor Model<br/>31 items</i> | <i>Adjusted<br/>Proposed 3-<br/>factor Model<br/>21 items</i> | <i>1-Factor<br/>Model<br/>20 items</i> | <i>3 plus 5<br/>Model<br/>20 items</i> |
| <b>Chi-square</b> | 1745.03   | 767.49  | 983.07                                 | 486.53                                 |
| <b>Df</b>         | 432   | 187   | 170                                    | 163                                    |
| <b>P</b>          | .00   | .00   | .00                                    | .00                                    |
| <b>GFI</b>        | .85   | .92   | .90                                    | .95                                    |
| <b>AGFI</b>       | .83   | .91   | .87                                    | .93                                    |
| <b>CFI</b>        | .88   | .91   | .87                                    | .95                                    |
| <b>NFI</b>        | .84   | .89   | .85                                    | .93                                    |
| <b>TLI</b>        | .87   | .90   | .86                                    | .94                                    |
| <b>RMSEA</b>      | .03   | .03   | .05                                    | .04                                    |
| <b>RMR</b>        | .07   | .06   | .07                                    | .05                                    |

### *1-Factor Solution*

Exploratory factor analysis (principle components with promax rotation) of the 31 items suggested the presence of a strong single factor (see Table 2). Moreover, when factor analysis was constrained to a 1-factor solution, all 31 items loaded adequately (>0.3) onto the single factor. This

provided support for the uni-dimensional model of the social processes of leadership. In order to compare the 1-factor solution with the other fitted models, items with the lowest loadings on the single factor indicated by the CFA were withdrawn to enhance fit. The final 1-factor solution consisted of 20 items. Fit indices for this model are given in Table 1. Therefore, even by reducing the SPL scale to 20 items, the one-factor model, which was suggested by exploratory factor analysis, was not sustainable when subjected to CFA.

**Table 2. Eigenvalues from Exploratory Factor Analysis of 31 SPL items**

| Factor | Eigenvalue | Cumulative % of Variance |
|--------|------------|--------------------------|
| 1      | 12.76      | 41.17                    |
| 2      | 1.32       | 45.45                    |
| 3      | 1.24       | 49.46                    |
| 4      | 1.13       | 53.09                    |

*Model of Best Fit*

Because the fit indices of the adjusted proposed three-factor model were only marginally adequate, I proceeded to look for a factor structure that was more appropriate to the data, and that was theoretically defensible. A third model was proposed and submitted to CFA (see Figure 2). This model also reflected the hierarchy of abstraction wherein sub-factors of the social processes were represented. By constraining error variances on this model to zero, potential problems with multicollinearity were offset. This practice added rigour to the resultant model. It also helped to reduce the impact of same source bias. A comparison of the fit indices in Table 1 demonstrates the superior fit of this 3-plus-5 model. Table 3 provides inter-correlations and Cronbach alphas of the derived SPL factors. Tables 4 and 5 present Cronbach alphas, means, standard deviations and inter-correlations of extant constructs. Correlations between these measures and the 4 derived social process factors are also included.

**Table 3. Correlation Matrix of Sub-levels of Process of the Social Processes of Leadership**

|                                 | <b>MAINLY<br/>OPTIMISING</b> | <b>MAINLY ENHANCING<br/>ADAPTABILITY (EA)</b> |                              |                                  |
|---------------------------------|------------------------------|---|------------------------------|----------------------------------|
|                                 | <i>Active<br/>Management</i> | <i>Team Support &amp;<br/>Communication</i>   | <i>Personal<br/>Efficacy</i> | <i>Resolving<br/>Uncertainty</i> |
| Active Management               | (.87)                        |   |                              |                                  |
| Team Communication<br>& Support | .64                          | (.66)   |                              |                                  |
| Personal Efficacy               | .66                          | .64   | (.64)                        |                                  |
| Resolving Uncertainty           | .72                          | .60   | .60                          | (.78)                            |
| MEAN                            | 2.84                         | 3.1   | 3.0                          | 2.7                              |
| STD. DEVIATION                  | .61                          | .57   | .57                          | .60                              |

All correlations significant at  $p < .01$

Figures in parenthesis are Cronbach Alphas

|   | 1     | 2     | 3     | 4     | 5     | 6     | 7     | 8     | 9     | 10    | 11    |
|---|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| 1 Transformational                          | (.93) |       |       |       |       |       |       |       |       |       |       |
| 2 Articulates vision                        | .91   | (.89) |       |       |       |       |       |       |       |       |       |
| 3 Provide appropriate model                 | .88   | .64   | (.91) |       |       |       |       |       |       |       |       |
| 4 Fosters acceptance of goals               | .89   | .66   | .80   | (.86) |       |       |       |       |       |       |       |
| 5 Support for innovation                    | .50   | .45   | .43   | .45   | (.90) |       |       |       |       |       |       |
| 6 Resource supply                           | .44   | .39   | .38   | .39   | .70   | (.80) |       |       |       |       |       |
| 7 Conscientiousness                         | .50   | .39   | .49   | .49   | .40   | .37   | (.83) |       |       |       |       |
| 8 Courtesy                                  | .44   | .35   | .40   | .44   | .36   | .35   | .50   | (.87) |       |       |       |
| 9 Communication                             | .60   | .46   | .56   | .63   | .42   | .34   | .48   | .39   | (.76) |       |       |
| 10 Workload sharing                         | .48   | .39   | .47   | .45   | .27   | .26   | .50   | .31   | .50   | (.75) |       |
| 11 Cohesion                                 | .53   | .43   | .49   | .53   | .42   | .35   | .44   | .37   | .58   | .47   | (.72) |
| 12 Active Management (Mainly Optimising)    | .81   | .69   | .74   | .75   | .38   | .36   | .49   | .43   | .59   | .52   | .81   |
| 13 Team Communication & Support (mainly EA) | .63   | .52   | .59   | .62   | .34   | .28   | .42   | .36   | .57   | .43   | .49   |
| 14 Personal Efficacy (Mainly EA)            | .67   | .58   | .62   | .61   | .42   | .37   | .43   | .34   | .51   | .40   | .47   |
| 15 Resolving Uncertainty                    | .71   | .66   | .59   | .62   | .39   | .35   | .39   | .38   | .55   | .37   | .53   |
| Mean  | 2.8   | 2.6   | 3.0   | 2.9   | 2.7   | 2.2   | 2.9   | 2.8   | 3.2   | 2.8   | 3.0   |
| Std. deviation                              | .69   | .78   | .79   | .76   | .67   | .65   | .68   | .86   | .59   | .80   | .64   |

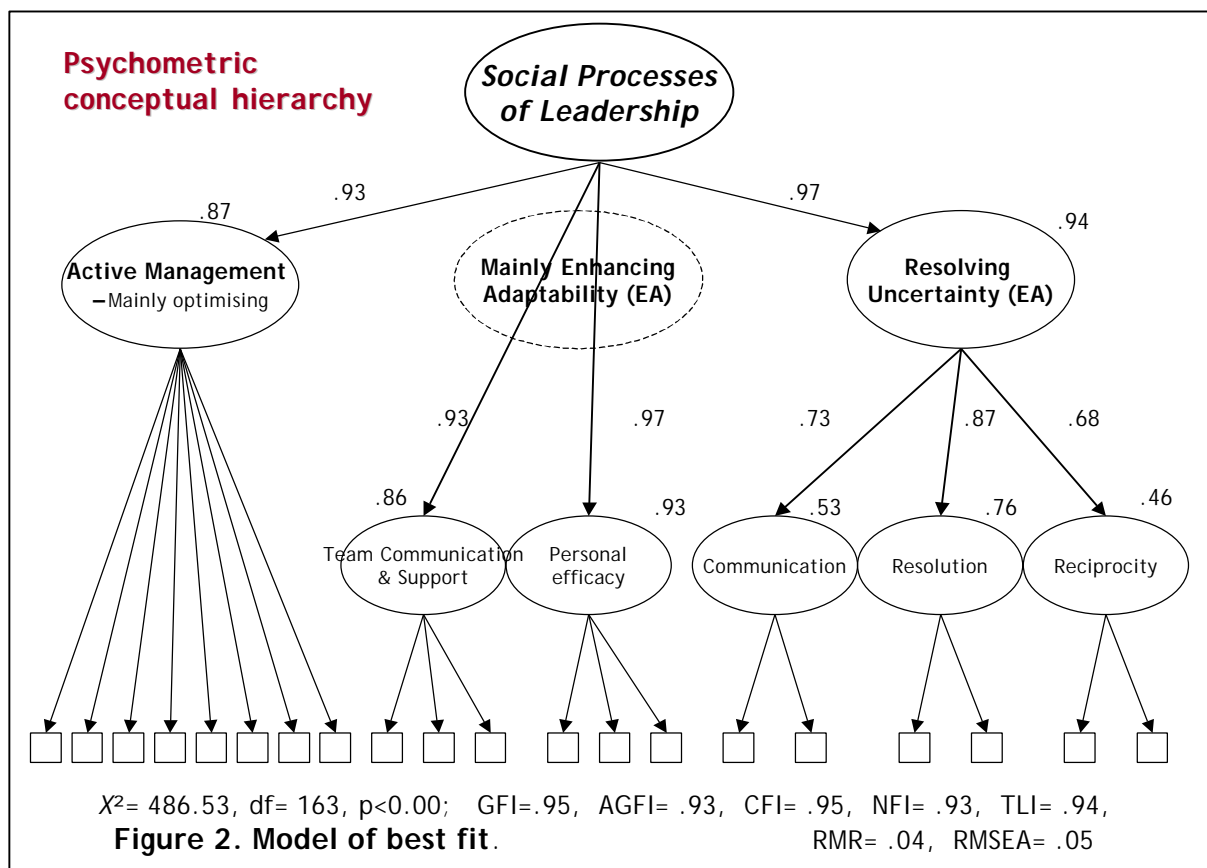
Note: All correlations are significant at the 0.01 level (2-tailed).

Figures on the diagonals represent Cronbach alphas

|   | 1     | 2     | 3     | 4     | 5     | 6     | 7     | 8     | 9     | 10    |
|---|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| 1 Contingent Reward                         | (.79) |       |       |       |       |       |       |       |       |       |
| 2 Insp. Motivation                          | .69   | (.86) |       |       |       |       |       |       |       |       |
| 3 MBEP                                      | -.33  | -.45  | (.74) |       |       |       |       |       |       |       |
| 4 Humour                                    | .42   | .39   | -.14  | (.87) |       |       |       |       |       |       |
| 5 Sportsmanship                             | .45   | .57   | -.56  | .23   | (.86) |       |       |       |       |       |
| 6 Civic virtue                              | .37   | .46   | -.37  | .19   | .36   | (.67) |       |       |       |       |
| 7 Altruism                                  | .57   | .55   | -.36  | .44   | .48   | .49   | (.81) |       |       |       |
| 8 Task Cohesion                             | .49   | .56   | -.49  | .35   | .63   | .36   | .57   | (.75) |       |       |
| 9 Social Cohesion                           | .37   | .41   | -.33  | .29   | .34   | .29   | .44   | .35   | (.82) |       |
| 10 Trustworthiness                          | .54   | .59   | -.48  | .32   | .63   | .41   | .63   | .70   | .40   | (.88) |
| 11 Active Management (mainly Optimising)    | .64   | .71   | -.47  | .37   | .56   | .45   | .60   | .57   | .40   | .65   |
| 12 Team Communication & Support (Mainly EA) | .53   | .53   | -.32  | .36   | .42   | .35   | .54   | .54   | .33   | .58   |
| 13 Personal Efficacy (Mainly EA)            | .54   | .64   | -.39  | .36   | .47   | .39   | .51   | .57   | .38   | .55   |
| 14 Resolving Uncertainty                    | .64   | .65   | -.33  | .39   | .40   | .37   | .55   | .48   | .41   | .55   |
| Mean  | 2.6   | 2.7   | 1.5   | 2.3   | 2.7   | 2.6   | 2.9   | 2.9   | 2.0   | 3.3   |
| Std. Deviation                              | .65   | .76   | .69   | .81   | .83   | .64   | .62   | .81   | .89   | .62   |

Note: All correlations are significant at the 0.01 level (2-tailed).

Figures on the diagonals represent Cronbach alphas



## DISCUSSION & CONCLUSIONS

The first intended outcome of this line of research was to validate extant social process of leadership (SPL) theories that have been undertaken using the grounded theory method. There is support for claiming that this outcome has been achieved. In general, the results provide support for a multiple-factor solution of the SPL that represents the three proposed leadership processes (which in turn were axiomatic of the SPL theories). The factor with the clearest match to the original theory was resolving uncertainty. However, in contrast to the original theory, resolving uncertainty was found to be distinct from enhancing adaptability. Optimising and enhancing adaptability were theorized *a priori* to have considerable conceptual overlap, particularly where they converged on existing leadership theory. This final solution represented this overlap. For example, active management was predominantly made up of optimising processes but also included two enhancing adaptability items. Similarly, an optimising item was included in one of the derived enhancing adaptability factors.

Figure 2 represents the psychometric *hierarchy of abstraction* model. Enhancing adaptability could not be isolated on this model as a discrete higher-order latent construct. However, the two lower-order constructs of ‘team communication and support’ and ‘personal efficacy’ both reflected enhancing adaptability, and both could be isolated on the hierarchy of abstraction model. The discreteness of these two factors provides support for the distinct presence of the latent construct representing ‘enhancing adaptability’. The reason that enhancing adaptability could not be isolated on the hierarchy of abstraction model is that it correlates highly with the optimising construct (‘active management’) and with resolving uncertainty. Rather than seeing this as a methodological problem, I

see it as further confirmation of the conceptual similarity between these constructs. Similarly, the sub-constructs of 'optimising' could not be isolated. Again, this was because of the highly correlated nature of the manifest variables reflecting these latent constructs.

The terminology for the lower-order latent constructs in Figure 2 is different from those proposed in the grounded conceptual hierarchy that was originally tested. This is because there are fewer items remaining within each latent construct in the psychometric conceptual hierarchy than were proposed in the grounded conceptual hierarchy. For example, the three items that remain in 'personal efficacy' reflect that title more so than they reflect 'follower adaptability' or 'leader adaptability'. However, 'personal efficacy' is just as accurate a representation of the discrete lower-order construct that has resulted from this analysis, as 'leader adaptability' and 'follower adaptability' are of the conceptually similar constructs that emerged from the grounded theory research.

As predicted, a multiple-factor solution provided the best fit of the data. However, in addition, the results also provided a degree of support for a higher-order one-factor solution. In both exploratory and confirmatory factor analyses, a one-factor solution was suggested. Moreover, as modelled in Figure 2, there is sufficient overlap of the four derived SPL constructs (reflecting the three social processes) to support a higher-order factor of 'Social Processes of Leadership'. Hence, the second intended outcome of this line of research, to test for the presence of discreet sub-constructs at lower levels of abstraction, has been achieved.

The third intended outcome of this line of research was to determine relationships between existing leadership/organizational constructs and SPL theory. Correlational analyses between the derived SPL constructs and the existing leadership and organisational processes indicated the convergent validity of the SPL theories. Significant positive correlations were found between SPL factors and all extant constructs that had been previously related to effective management practice. Also, as predicted, negative correlations were found only between the SPL factors and management-by-exception-passive (MBE-P), a measure of corrective transactional leadership. MBE-P is a leadership construct identified by Bass (1985, 1988) that has been consistently negatively correlated with effective leadership (Bass, 1988; Parry & Proctor, 2000).

Of additional note are the high positive correlations between transformational leadership and the SPL constructs. Bass and Avolio's (1993) and Podsakoff et al's (1990) transformational constructs all correlated with the SPL constructs between  $r = .52$  and  $.81$ . This finding supports conceptual overlaps described in the original SPL theories between transformational leadership and optimising, resolving uncertainty and enhancing adaptability (Irurita, 1997; Parry, 1998). Due to the conceptual and empirical similarity between SPL and transformational leadership it may be that practitioners can use transformational leadership as a measure of the presence of desirable social processes of leadership within organisations. However, this proposition must be subject to further analysis before it can be accepted.

In general, there is support for the continued investigation of leadership through grounded theory-based work. I would suggest that based on these findings, quantitative theorists would advocate the continued use of the grounded theory method to research leadership and associated social processes in organisations. Moreover, the successive and progressive analysis of the social processes of leadership within quantitative *and* qualitative investigations is likely to provide a promising avenue for the development and testing of comprehensive and valid leadership theory. Finally, there is psychometric support for the hierarchy of abstraction that is so much a part of the grounded theory method. Perhaps the major achievement of this research is that H.A.M. modelling spans the paradigm divide. It does this by representing both hypothesized relationships and theoretical relationships within the quantitative paradigm as well as within the qualitative paradigm. Consequently, hierarchy of abstraction modelling may provide a rich source of insight for future researchers, whether using an ideographic approach and qualitative methods like grounded theory, or whether using the nomothetic approach characterised by mainstream quantitative methods.

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