A methodological tool for work-related stress management: Importance-Performance Analysis used complementary to PLS path modelling

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1. Introduction
Work-related stress

• A major public health issue: it has negative effects on both physical and psychological health

• Although stress is an inevitable part of organizational life, effort can be made to reduce its negative effect on health:
  → job characteristics (stressors) impacting a high level of perceived stress well-documented;
  → impact of each stressor measured in a multidimensional way.
Quantitative assessment

• Theoretical frameworks have been successful in generating and collecting data on work-related stressors;

• Limited literature on quantitative assessment of stressors impact on work-related stress considering the multidimensional aspect of this type of data.
2. Study data
Stress & stressors data

• Provided by **Stimulus** (expert in occupational health & wellbeing) → 10 000 anonymous employees randomly drawn from different companies.

• Tools:
  – 1\textsuperscript{st} questionnaire on work-related stress
  – 2\textsuperscript{nd} questionnaire on job characteristics

→ both administrated to employees during their routine visit in preventive medicine service.
Stress

• 1\textsuperscript{st} questionnaire: 25 items to measure individual psychological stress at work → 8-point Likert scale.

• Example:
  
  “I'm confused and I lack focus and concentration” , answer varies from \textcolor{red}{1} “not at all” to \textcolor{red}{8} “enormously”
Stressors

• 2nd questionnaire: 58 items to measure the impact of job characteristics (stressors) → 6-point Likert scale.

• Ex. 1: “My company does not care about employees well-being” (negative)
  answer varies from 0 “totally disagree” to 5 “totally agree”

• Ex. 2: “I know clearly what I am expected to do at work” (positive)
  answer varies from 0 “totally agree” to 5 “totally disagree”
3. Cooper’s index limitations

Cooper index

• Prioritize professional stressors impacting work-related stress $\rightarrow$ Cooper index

• **Aim:** provides companies a quantitative risk assessment approach to prioritize psychosocial risks at work.

• **Approach:** identify **stressors** related to high stress level:

  Risk factor = exposure $\times$ consequences

  $r^2$ (stressor; stress outcome)

  Perceived level of a stressor
1) Easy to use but questionable! $r^2 \times \bar{x}_1$ m is not a risk (or an impact) measure

Same variability, same correlation, $\bar{x}_2 > \bar{x}_1$. ➔ $x_1$ and $x_2$ have the same risk. However, using Cooper’s index, $x_2$ should be riskier than $x_1$!

$\text{Cor (} Y, x_1 \text{)} > \text{Cor (} Y, x_2 \text{)}, x_2$ more variable $\bar{x}_2 = \bar{x}_1$ ➔ $x_2$ is riskier than $x_1$! However, using Cooper’s index, $x_1$ should be riskier than $x_2$!
Limits (2)

2) No consideration of inter-correlations between stressors!

3) Confusion between correlation and causality! acting on a stressor could cause changes in other stressors
4. Suggested approach
Suggested approach

1) PLS path modeling:
   – To investigate the impact of job characteristics on perceived work-related stress in a multidimensional way

2) Importance-performance analysis:
   – To identify stressors requiring a priority action

4.1. PLS Path Modeling

## Homogeneity of the 6 blocks

<table>
<thead>
<tr>
<th>Latent variables</th>
<th>No. of Items</th>
<th>$1^{st}$ $\lambda$ &amp; Cronbach $\alpha$</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>1\textsuperscript{st} questionnaire: « stress »</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Work-related stress</td>
<td>25</td>
<td>33.6</td>
</tr>
<tr>
<td><strong>2\textsuperscript{nd} questionnaire: « stressors »</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Work context</td>
<td>14</td>
<td>8.95</td>
</tr>
<tr>
<td>Job control</td>
<td>14</td>
<td>7.15</td>
</tr>
<tr>
<td>Relationship</td>
<td>12</td>
<td>7.01</td>
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<tr>
<td>Tasks</td>
<td>12</td>
<td>5.37</td>
</tr>
<tr>
<td>Recognition</td>
<td>6</td>
<td>5.98</td>
</tr>
</tbody>
</table>
Outer model

- All outer weights are statistically significant ($\alpha = 5\%$)

Measurement model quality is satisfactory

<table>
<thead>
<tr>
<th>Latent Var.</th>
<th>Manifest Var.</th>
<th>Outer weight</th>
<th>95% Confidence Interval</th>
</tr>
</thead>
<tbody>
<tr>
<td>Context_01</td>
<td>0.116</td>
<td>0.110</td>
<td>0.122</td>
</tr>
<tr>
<td>Context_08</td>
<td>-0.069</td>
<td>-0.074</td>
<td>-0.064</td>
</tr>
<tr>
<td>Context_15</td>
<td>-0.077</td>
<td>-0.082</td>
<td>-0.072</td>
</tr>
<tr>
<td>Context_21</td>
<td>-0.096</td>
<td>-0.100</td>
<td>-0.092</td>
</tr>
<tr>
<td>Context_23</td>
<td>-0.096</td>
<td>-0.100</td>
<td>-0.092</td>
</tr>
<tr>
<td>Context_30</td>
<td>-0.088</td>
<td>-0.092</td>
<td>-0.084</td>
</tr>
<tr>
<td>Context_32</td>
<td>-0.085</td>
<td>-0.089</td>
<td>-0.081</td>
</tr>
<tr>
<td>Context_34</td>
<td>0.090</td>
<td>0.086</td>
<td>0.095</td>
</tr>
<tr>
<td>Context_40</td>
<td>-0.080</td>
<td>-0.084</td>
<td>-0.076</td>
</tr>
<tr>
<td>Context_41</td>
<td>0.096</td>
<td>0.090</td>
<td>0.102</td>
</tr>
<tr>
<td>Context_43</td>
<td>-0.080</td>
<td>-0.085</td>
<td>-0.076</td>
</tr>
<tr>
<td>Context_52</td>
<td>0.092</td>
<td>0.087</td>
<td>0.097</td>
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<tr>
<td>Context_53</td>
<td>0.108</td>
<td>0.103</td>
<td>0.113</td>
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<td>Context_57</td>
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<td>-0.081</td>
<td>-0.071</td>
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</tbody>
</table>

Work context
### Correlation between blocks

**Correlation between latent variables:**

<table>
<thead>
<tr>
<th></th>
<th>Context</th>
<th>Control</th>
<th>Recognition</th>
<th>Relationship</th>
<th>Tasks</th>
<th>Stress</th>
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</thead>
<tbody>
<tr>
<td>Context</td>
<td>1.00</td>
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<td></td>
<td></td>
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<tr>
<td>Control</td>
<td>0.78</td>
<td>1.00</td>
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<tr>
<td>Recognition</td>
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<td>0.63</td>
<td>1.00</td>
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<td></td>
<td></td>
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<tr>
<td>Relationship</td>
<td>0.69</td>
<td>0.67</td>
<td>0.60</td>
<td>1.00</td>
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<td></td>
</tr>
<tr>
<td>Tasks</td>
<td>0.61</td>
<td>0.72</td>
<td>0.54</td>
<td>0.53</td>
<td>1.00</td>
<td></td>
</tr>
<tr>
<td>Stress</td>
<td>-0.52</td>
<td>-0.63</td>
<td>-0.43</td>
<td>-0.51</td>
<td>-0.52</td>
<td>1.00</td>
</tr>
</tbody>
</table>
PLS rather than SEM

• Blocks are mutually positively and strongly related!

⇒ PLS-path modeling is a more appropriate approach

• Structural equation model (SEM): potential collinearity might bias the results of the underlying multiple regression analysis.
Estimation of path coefficients

Path coefficients (contribution to $R^2=40\%$)
4.2. Importance-Performance Analysis
A graphical approach

IPA is a valuable approach for customer satisfaction studies.
Performance & Importance

Performance

Measured as the score mean over the 10 000 responses

Importance

Calculated using the suggested formulae:

Importance (k\text{th} item) = |\text{Outer weight (k\text{th} item in j\text{th} block)}| \times \text{Path coefficient (j\text{th} block, stress)}
Stressors to improve

5 items were identified in Quadrant A, where improvement in performance is most pressing and upon which the management should concentrate:

Task_PS46: « I have to work fast in a short timeframe »
Recon_PS07: « My promotion prospects are weak »
Recon_PS17: inverse of « My company offers me interesting career opportunities »
Task_PS31: « I work in a noisy and hectic atmosphere »
Recon_PS35: inverse of « I am rewarded when I reach my goals »
Stressors to maintain

6 items are identified in Quadrant B, where efforts should be maintained:

Task_PS13: « I frequently see the work pile up without being able to eliminate the backlog »

Task_PS24: inverse of « My work gives me many opportunities to perform interesting tasks »

Task_PS03: inverse of « My work means a lot to me »

Task_PS04: « My job is about monotonous and repetitive tasks »

Contro_PS09: inverse of « I can achieve professional life - personal life balance »

Contro_PS54: « I'm living or I expect to live an undesirable change that might affect my career »
Robustness analysis

• IPA’s robustness against a change in the scale used to categorize the answers to the 58 items related to professional stressors was tested
• 6-point Likert scale for individuals’ answers to each of the 58 items, we *dichotomized* the answers as follows: Negative responses coded 0
  Positive responses coded 1
• Similar distribution of the items in the four quadrants.
  > Robustness of the IPA’s results.
5. Conclusion and perspectives
Conclusion

• PLS path modeling and IPA based approach could be a useful tool for the policy of psychosocial risks management at workplace

• Sequence of the performed approach:

  - Conceptual model built by experts
  - Study questionnaires developed using this model (validated instruments)
  - Data collected during preventive medicine visit (high quality)
  - Prioritize stressors needed (Importance-performance analysis)
  - PLS model predicted successfully stress via LV (deal with colinearity)
Perspectives

Causal analysis

Correlation does not imply causality, a causal analysis should be performed to determine the stressors on which to act in order to reduce psychosocial disorders associated with stress.


The causal model could be validated using longitudinal data collected after an intervention plan on work-related stress.
We combined IPA), with Partial Least Squares-Path modeling (PLS-PM), a major statistical tool widely applied in psychosocial and marketing research. PLS-PM was used to predict the impact of five blocks of stressors on work-related stress. The obtained coefficients were used to calculate item importance in IPA and directly identify items requiring priority attention. The method was shown to be robust to changes in the coding of questionnaire items.